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FRIDAY, NOVEMBER 23, 1855.

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FIRST ORDINARY MEETING.

Wednesday, November 21, 1855.

The First Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 21st instant, the Rev. James Booth, LL.D., F.R.S. Chairman of Council, in the chair.

The following Institution has been taken into Union since the last announcement:—

403. Wilton (near Salisbury) Institute.

The Rev. Dr. Booth, as Chairman of Council, then read the following

ADDRESS.

In accordance with the custom, sanctioned by long prescription, which requires that the Chairman of the Council of your Society, should, in the words of one of our rules, "read an address at the opening of the Session declaratory of the course the Council propose to follow in the forthcoming Session," I now venture to address to you a few observations on the present occasion, and I promise to be as brief as the variety and extent of the subjects I shall have to touch upon will permit me to be. You will bear with me while I assert the utility, and advocate the claims on public support, of Societies such as ours. We assemble here, we meet in social converse for the friendly interchange of thought, and it may be—no doubt it has often happened—that a notion suggested, or a casual hint thrown out, may, by the operation of the laws of association, connect itself with some latent train of ideas, perhaps long forgotten, but now kindled as by a spark into a blaze of light, and thus lead to a series of researches and discoveries which may only be the brightening of the horizon before the full brilliancy of some grand discovery shall burst upon the view. Again, induced by the generous encouragement and the judicious rewards which, from the earliest period of its associated life, our Society has held forth, how many have turned their attention to some special department of art or manufacture. Our prize list from year to year has given a stimulus to the inventive faculties of our members, and has been the means of turning their ideas into that particular groove of thought which at length has led to the discovery of some process, or to the invention of some machine, that has conferred, or may be destined to confer, the greatest benefits on our manufacturing industry.

In another respect, too, societies such as ours are eminently useful. Men engaged in the dull steady routine of daily employment, run no small danger that their intellects may be blunted, and finally corroded with the rust of long disuse; for such men societies, whether literary or scientific, afford a wholesome stimulus and relaxation. The instances are by no means rare in which we find those who are engaged during the day in the busy turmoil of commercial pursuits, devoting with untiring ardour and commensurate success their leisure hours to scientific investigations. Nor is it at all strange that this should be the case; for to an active mind, engaged during the greater portion of the day in occupations which exercise only a particular class of the mental faculties, it is no irksome task, but rather a relaxation—an unbending of the bow, so to speak—to employ it in pursuits which bring into play other faculties and other operations of the intellect. Let no one be discouraged by the groundless notion that the fields of man's discovery in Nature's wide domains are already reaped and garnered, or that at the most but a few gleanings now remain to reward the patience of the most diligent inquirer. It is not so; the fertility of Nature is inexhaustible; one discovery but gives the clue to a series of others. And if it be a just assumption, as I have no doubt it is, that the secrets of Nature are actually infinite, the more we discover the greater the facility that will attend the process of discovery; for the relations that bind the phenomena of Nature together, and which are the very elements of man's knowledge, increase in a far higher proportion than the phenomena themselves. It is, indeed, more in accordance with that adaptation of means to ends which, so far as we are permitted to know, pervades the whole of creation, more in unison with the stability of the order of Nature, and with the uniform evidence of all our accumulated knowledge, to hold that so long as the human intellect shall remain such as it is, pleased with research and delighted with discovery, so long, to the remotest verge of time, will new truths arise, and new relations between them and the old be found, with the same exhaustless progression as ever—*labitur et labetur.* As the cataract ever thunders down, and the tides of the ocean never stay their ceaseless roll—as the physical aspects of nature undergo perpetual and progressive change,—a sound analogy would lead us to infer that the currents of the intellect will never become stagnant, nor the springs of the mind exhausted. Let no one, then, who pursues knowledge for its own sake despair, or be doubtful of eventual success, for though it may be that, pursuing an untrodden path he shall arrive at last at some known and beaten track, yet the chances are quite as much, nay, far more, in his favour, that he shall at length reach some unexplored region of undiscovered truth.

I have spoken, more than enough perhaps, in defence of Scientific Associations in general, but I cannot pass from the subject without saying a few words on behalf of our own Society, which has sometimes been censured by those who do not accurately realise our exact scope, or the aim we propose to ourselves. We are not associated, like the Fellows of the Royal Society, for the purposes of physical discovery, or mathematical research. The names of the Geographical, Geological, Astronomical, and other kindred Societies sufficiently indicate the precise objects on which they are respectively engaged, and we should naturally be much surprised should any one of them deviate from the well-defined course laid down for it. But our Society fills a wide sphere of action; under the comprehensive title, "the Encouragement of Arts, Manufactures, and Commerce," our chartered field of operation, almost every question of social advancement comes legitimately within our province;—in short, the cardinal idea to which all the varied objects and proceedings of our Society may be referred and subordinated is *Progress.* Progress in Arts, progress in Manufactures, progress in Commerce. Looked at from this point of view, all our proceedings and measures of the last few years will be seen to follow as legitimate consequences of that one fundamental idea carried out into action. Thus, if it be objected that the Society of Arts has failed in bringing some of its projects to a successful issue, this even, if true, would detract but little from the wisdom of the attempt, for it would only tend to shew that social advancement was not to be sought in that direction. Bacon well observes, that the "abortions of time as well as the births should be registered." Hence even our very failures are useful, because they contract the field for our investigation. Of several roads which intersect at a point, they tell us those which will not lead to the place of which we are in quest, and this negative knowledge is of no little value. "Social advancement," in its broadest meaning, is our motto. To this are all our efforts directed. The labours of other Societies and the assistance of their members, we freely avail ourselves of. The abstract researches and the physical discoveries which so appropriately grace the annals of the Royal Society, we bring down to the common uses of mankind at large, and make them minister to material comfort or social improvement. We do not forget that Lord Bacon, the great promoter of reformed physical investigation, has himself observed, that "the true and legitimate end of all the sciences is to enrich man's life with new inventions and appliances." Thus the chemical property of the unseen rays of the solar spectrum to turn chloride of silver black, led step by step to the daguerreotype and the talbotype. Taking these discoveries, which at first were looked upon rather as philosophical curiosities, the Society of Arts endeavoured to turn them to practical use, and held the first public exhibition of photography in these rooms, of which the Photographic Society is the result. Again, it applies the botanical science of some of its most distinguished members to the practical inquiry, whether any or what vegetable products, such as fibrous substances, might be introduced into this country from our colonies, either as profitable substitutes for material already in use, or as entirely new elements in our manufacturing industry. The annals of our Society, even at the present day, are full of examples of the success which has attended our efforts in this direction.

Is a discovery in Chemistry announced? Without delay we endeavour to stimulate the chemists to apply it to the improvement of some manufacturing process confessedly imperfect. Does any great commercial question, or social movement, or sanitary reform fix the attention of the public? It is discussed and ventilated in this room, and I will say not seldom with considerable advantage. Thus, for example, the subject of limited liability, the repeal of the paper duty, the origin and nature of strikes, the smoke nuisance, &c., have each been here thoroughly discussed.

Our Society has always striven to give the widest diffusion to all such discoveries as held out the prospect of being generally beneficial. During a period of our social history, when protection and monopoly were held by our most eminent statesmen and most expert statists to be the very tap roots of commercial prosperity and manufacturing industry, the Society of Arts discountenanced patents and monopolies of every kind. We had even then a dim perception of that great cardinal truth in social science, which has not even yet universally received that frank and undoubting acceptance which it will one day obtain—that the free and unfettered intercourse of nations, and the wide promulgation of truths, discoveries, and inventions among them, are the surest guarantees for their individual prosperity and lasting peace. It is indeed strange that we should be so long in getting at a truth which on the very face of it would seem to be almost self-evident. For if we take into account the vast variety of the animal and vegetable creations as diffused over the globe—the wide diversities of soils, localities, and climates—the configuration of the earth's surface, affording such facilities for commerce by its rivers, seas, and harbours; if we consider the fact, denied by none, that no country, however extensive, contains within its bounds all that it requires; if, moreover, we add to these the migratory instinct implanted in the heart of man,—surely it is no forced nor far-fetched conclusion to surmise that Providence ordained man should hold free intercourse with his fellows; and if so, it will next follow, as a logical inference, that this intercourse must tend to the benefit of all, and that the greatest good of the whole consists in the greatest good of its several parts. Thus it is commercially as well as philosophically false that a nation becomes rich because its neighbours are poor, or that its prosperity is based on their calamity.

Again, by a sort of reflex operation, we make the improvements and consequent cheapness of the products of our manufacturing industry react upon the social improvement of the poorer classes of our population; of this I cannot give you a more striking instance than the remarkable success which has attended the efforts of our Vice-President, Mr. Twining, whose philanthropic labours have in so marked a manner called forth the approbation of the Emperor and the Empress of the French; and it is with much satisfaction I add—a satisfaction in which I am sure you will all most freely share—that he has been most deservedly honoured at the recent distribution of civic decorations by the Emperor of the French. Our Society, through Mr. Twining, has been associated in the minds of the French people with this movement, and has shared the credit which the idea of an Economic Museum so justly deserves.

I am sure I do no more than give utterance to our general wishes when I express an earnest hope that of the many Societies which have gone out from amongst us, from the days of the infant Royal Academy to our own, *The Special Museums for the Working-Classes* may prove neither the least successful nor the least useful. I regret much that our very confined space will not permit us to retain the collection permanently amongst us. This is but one instance out of many, of the heavy damage and great discouragements our Society has to bear from the confined and inadequate accommodation which in these premises we are compelled to put up with.

Owing also to the same cause the Council have been induced to accept the offer of the Royal Commissioners to take the Trade Museum of animal produce off their hands, and to pay the expenses incurred by the Society in its formation. The Council have stipulated with the Royal Commissioners that this very valuable collection, brought together by Professor Solly, shall be exhibited to the public on very advantageous conditions, immediately a suitable building, now in preparation, shall be ready to receive it.

I am relieved from the duty of entering into a fuller exposition of the aims and objects of our Society, and I must forego the pleasure of giving a detailed statement of the good it has accomplished during the past century, as I have been anticipated by my two immediate predecessors in this chair, Mr. Chester and Lord Ebrington, to whom our Society owes so much. They have entered at considerable length into the details of our history. That history would, I have little doubt, be found still more clearly written in the annals of the progress of the agriculture, the arts and manufactures of this country, and may I add, to some extent, of the colonies too.

To those who reside at a distance from London, or who cannot conveniently attend our evening meetings, the *Journal* of the Society supplies a weekly *resumé* of our proceedings. As it is a very heavy charge on the funds of the Society, I regret that our members do not more fully develop its capabilities. Its pages are always open to important facts, new views, or novel speculations. Were each member to communicate the facts that come under his own observation, kindred to the spirit of the *Journal*, or give information not easily to be had elsewhere, or impart knowledge bearing on those matters about which the Society is engaged, I have little doubt that the *Journal* might be made a publication of great interest, and an organ of the opinions of some 70,000 intelligent persons. This is clear, for the Institutions might use its pages to a much greater extent than they do at present, to make known their wants and to record their opinions. It is only in this way that our *Journal* can ever become of value as an exponent of public opinion. I must reiterate my regret and that of the Council that an instrument so costly and of such latent power should not be more extensively used. To those members who are engaged in researches often of the highest value,—to those inventors, some of whom unfortunately, like the late Mr. Cort, of puddling and rolling memory, enrich the nation while they beggar themselves,—to those who seek publicity for their ideas, and fair play for their development, to all such our Society affords an open field and free discussion. But for the Society of Arts, the Great Exhibition, which stamps its impress on the time, and marks an era in the social progress of nations, instead of being a realised fact would still be nothing more than a misty conception, or at best a fair vision in the mind's eye of some dreamy projector.

You are no doubt prepared to learn,—in fact most of you must be aware,—that the Council of last session laboured strenuously to redeem the pledges it gave through its chairman. If it has not been completely successful, some allowance must be made for the difficulty of the time, and the little interest public men take or indeed can take just now in the advancement of science, or in the growth of social improvement, or in the spread of education. Indeed, Lord Bacon long ago complained, and the complaint has not since been redressed, that States were too busy with their laws and too negligent in point of education.

The Council have gone to the expense and trouble of having a Bill carefully drawn, which, if accepted by the Government and passed into a law, will settle the question of the rating of Literary and Mechanics' Institutions on a satisfactory and simple basis. I cannot, however, conceal from you my own impression that the Government will scarcely, at the present juncture of public affairs, accept a bill which would necessarily open up a very wide and complicated financial question, and one, too, on which the best friends of the Institutions are by no means agreed. It will be the duty of the Council, however, to urge the matter on the attention of their Parliamentary Committee and the Government, and to use their best endeavours to bring the matter to a successful issue.

It hardly needs that I should bring under review the Society's recent visit to Paris, a step which was taken on the express recommendation of our illustrious President, His Royal Highness Prince Albert. The visit was a source of enjoyment to a very great number of the members and their friends, and although disappointment may have been felt in some cases, yet I have no doubt whatever that the visit was productive of great good, as drawing closer the bonds of union between two such nations as France and England. To the thoughtful members of the Society it must have been an agreeable reflection that the idea so vaguely and dimly elaborated at the Adelphi seven years ago, shone forth with such brilliancy in the gorgeous arcades of the *Exposition Universelle*. The Emperor, as you all know, was pleased to receive an address from the Society, and in reply he alluded in very flattering terms to the part taken by us in the inauguration of such universal displays of the world's art and industry. On that occasion one of our most respected members was permitted to bring under the notice of the Emperor the great importance of town drainage. In brief, but expressive terms, Mr. Chadwick pointed out the numerous advantages, both sanitary and commercial, which a system of thorough drainage would confer upon Paris and the other large and populous cities of France. Such has been the profound impression produced on the Emperor's mind by Mr. Chadwick's arguments and statistics, that he has been requested, I am informed, to reduce his views to practice, and one of the worst drained localities in Paris has been placed under his control.

It now remains that I express more definitely the views of my colleagues on the action of the Society during the forthcoming Session. Before I proceed to do so I must bring to your recollection that on the recommendation of the Council you have made some alterations and important improvements in our bye-laws; you have repealed some which had become obsolete, as they were framed on the assumption that the Exhibition of 1851 would be permanently continued. The most important change, however, will be found in the provision which requires that the special business of the Society, that is to say, the encouragement of arts, manufactures, and commerce, will be brought more directly into contact with the leading members of our Society in every department. It is the zeal, the knowledge, and the character of these men which alone shed lustre on our Society. Its Council is an executive committee, chosen out of the great body of the members for no special aptitude in these matters, but for their business habits, a fair share of common sense, but above all on the ground that they will not, either individually or collectively, lend themselves to countenance any thing which may savour of injustice or partiality. The names of the members of the Society selected to aid the Council by their judgment and advice, will be published for the future in the same manner as the names of the President, the Vice-Presidents, and the other members of Council. It is upon them that our reputation as a Society of Arts will henceforth chiefly rest. The Council, in matters of this kind, will be mainly guided by their judgment and advice.

The subject of lecturers for the Institutions in Union with us is now occupying the undivided attention of a committee specially nominated to devote their continuous attention to it, and I will only here say that the Institutions may rest satisfied that the Council will leave nothing undone to place the whole question of lectures and lecturers, if possible, in a more satisfactory position. But the subject is beset with difficulties of no ordinary kind, which for months together have perplexed and baffled successive Councils of your Society. Thus, some Institutions hold lectures but in small esteem; others will not have them at at all. Again, even of those who are importunate for a supply of lecturers, we have found in the actual working experience of the Secretary's office, that the Institutions of the same county, or even of the same neighbourhood, will neither reciprocate their advantages nor combine for united action. It thus becomes impossible to lay down beforehand an organised system of sending forth from the Society a selected staff of approved lecturers—men for whom the Society would not hesitate to be responsible—who, at a moderate charge to each, should proceed from Institution to Institution to deliver lectures day by day during their progress. This would be a practicable system, but the Institutions show but little disposition to support it. We have also published a very full list of lecturers and their subjects. It may have been found useful, but I much doubt whether its utility compensates its cost. The real information it contains is very accessible to those who desire to obtain it, even though they should not avail themselves of our catalogue. But let us pause, and ask are lectures of the great value which some would seem to endow them with. My own opinion, and to my sentiments my colleagues are in nowise committed, my own belief is, that they are, even the best of them, very much overrated. Whatever value may attach to lectures on moral or religious subjects, on those which set the imagination to work, or kindle the emotions, I am convinced, from long thinking over the subject, that scientific lectures, as they are called, or talk about physical phenomena, or abstract researches in pure science, are of very little educational value. They are useful because they amuse; they are pernicious because they beguile those who habitually listen to them into a loose sort of notion that they know something of science.

This may seem a very sweeping and a very needlessly wide generalisation on my part, but it is high time to put an end to this delusion in education. Men cannot scale the arduous and rugged paths of science by sitting still, and using only their ears. It was long ago said "There is no royal road to learning;" it is just as true that we cannot get there by railroad; every man must travel that journey for himself, on foot, happy if even foot-sore and weary he shall at length reach that "city placed upon a hill," "whose light cannot be hid." The grounds on which I have been led to hold this very unfashionable opinion are very convincing to myself. When we want to move the affections, to raise the passions, to influence the will, or to urge forward the action—in short, when we are required to operate on the emotions, then an oral discourse, whether it be called a speech or address, a lecture or a sermon, is unquestionably the true instrument to use. Now the signal efficacy of this mode of access to the mind being unquestionably, in its legitimate sphere, the excitation of the emotions, it was a very natural though unsound generalisation that the same method, oral teaching or lecturing, would develope the powers of the pure intellect. For, as I have elsewhere said, when we are required to bring into active exercise the reasoning powers of the understanding—whose characteristic mode of action was aptly designated by Newton, as patient thinking—which operate slowly, which must pause from time to time, look back, so to speak, and review—nay, sometimes travel over again and again—the steps of recent progress, where a series of unsuccessful tentatives are often of more real use to the mind than the admission into it of a suggested discovery, where the healthful exercise of the toilsome ascent, and not the prospect it commands is sought for, silent patient study is the only road by which we can in reality advance, and self-instruction is our best equipment for that road. The success of these, as means to an end, can be tested by examination alone. Action is equal to reaction in the material world around us; it would be against all analogy to expect that in the world of thought great intellectual force could be developed without an equivalent mental labour.

With respect to the matter of Decimal Coinage, or rather Decimal Accounts, the Council do not believe it expedient to appoint a committee to consider it. A committee whose members were all of one way of thinking, would probably not give satisfaction, and if constituted of divers opinions, it would very likely come to no result. It is an open field for obstinacy and ignorance to occupy, and they have not been slow to profit by the opportunity. The Council will however watch the progress of the question, and, should the necessity for it arise, will not fail to exercise any influence they may have, to secure a satisfactory solution of the question.

I come now to the most important question to which the Council of our Society can devote its attention during the forthcoming session, I mean that of education as promoted by systems of examination. The importance of examination as an efficient instrument for the promotion of education is every day receiving ampler recognition. Several years ago I gave much patient thinking to the problem, how the State could best promote the education of the people, especially of the middle classes, without provoking sectarian jealousy, or exciting political opposition. I worked it out in all its details, and I came at last to the settled conviction that examination is the only instrument the State can safely or efficiently use to promote the education of those classes who are able to defray the cost of the instruction they require. I published at the time the results in the form of a pamphlet, under the title, *Examination the Province of the State*. While many acknowledged the soundness of the views I had developed, several considered them too far in advance of the time, while some pronounced them altogether Utopian and visionary. Since that time our late chairman, Lord Ebrington, by an independent process of thought, arrived at nearly the same conclusion. In his letter to Mr. Chester, published in our Journal in July, 1854; in his speeches at the Conference which immediately followed; at several agricultural meetings, and still more recently in a memorandum which has appeared in the Journal of two week's back, his lordship has developed his views on the establishment of examinations for the sons of farmers, with much clearness and force. I need not recapitulate them, they are doubtless familiar to most of us. Again, in the *Report on Industrial Instruction*, presented to this Society in April, 1853, and published under the authority of the Council, the question of examination, considered as an instrument of the development of industrial instruction, was very fully discussed. While thus several independent thinkers were arriving successively at identical results, their views were very unexpectedly but most forcibly confirmed. The requirements of the Civil service became so imperatively pressing, while the long established mode of supplying vacancies therein, by the exercise of irresponsible patronage, was found to be so detrimental, that men of the highest standing in the public departments, such as Sir Charles Trevelyan and Sir Stafford Northcote, strenuously advocated an entire reformation of the present system, on the principle of making competitive examination the chief test of fitness for public employment.

It is somewhat remarkable that such very dissimilar inquiries as, how may vacancies in the Civil service be most efficiently supplied, and how may the State best promote the advancement of National Education, should have led two sets of independent thinkers to one and the same conclusion, that to make competitive examination the test of fitness for public employment, is not only the best way of supplying the wants of the public service, but the most effectual method that can be devised for the promotion and development of the education of the people. It is satisfactory to observe the rapid progress the question has made within the last few years. Not only is the system of testing proficiency by means of examination in operation at all our Universities, where long experience has tested its advantages, and on the largest scale, but within the last two years the patronage of the Directors of the East India Company has been appropriated by the legislature to reward successful industry and talent as tested by means of competitive examinations. In the same way very recently the War Department has thrown open to public competition appointments in the Engineers and Artillery. The Admiralty have just now followed this example in the establishment of a more efficient system of examination for cadets previous to their admission into the Navy. Earl Granville, as Lord President of the Council, and head of the Educational Department of the State, has inaugurated the same system, by admitting candidates to compete for clerkships in the Privy Council Office, on the conditions laid down in Mr. Chester's letter to the managers of the Wandsworth Trade School. Examination is once more revived in the Inns of Court. There is thus a general awakening of the public mind to the importance of having "the right men in the right places." The present system is too costly,—the nation cannot afford it. Inefficient services are dear at any cost. This might be a fitting place to discuss the causes which in so short a time have brought round an entire change in the opinions of the public. But as this aspect of the question has lately assumed somewhat of a political hue, and the Administrative Reform Association have taken it up on this ground, and press it on the attention of the country, I will not further discuss that bearing of the question here. It has received sufficient ventilation elsewhere. Yet, were not men swayed by long established forms and by words rather than things, it would be hard to explain why it should not be as much the birthright of an Englishman to demand the opportunity of serving his country, if found qualified, as to avail himself of his undoubted right to enter the professions of medicine or the law. Can any good cause be shown why it should not be as competent for him to compete for public employment as for a fellowship at Oxford or Cambridge? It is a sound provision of some old statute of the Plantagenets or Tudors, "None shall obtain offices by suit or for reward but upon desert."

I am entirely convinced that were such a system of general examinations in actual operation all over the country, an amount of intellectual power would at once become available for the common good, of which we can form but an incomplete notion at present. An eminent statesman of our own time, advanced in years, but more advanced in honour, has said there is no great bank of talent to be found on which the nation can draw to avert an intellectual bankruptcy.

This no doubt is true; and it is equally true there is no great hoard of gold now available in Australia; but would any one therefore deny that many a massive nugget and ponderous ingot of the precious metal lies buried, far out of sight, in the mire of some dark gully, or in the sands of some preadamite watercourse. They are there, we know, but until found and brought to light what do they avail us? So, though genius, energy, and talent, lie buried in the masses around us, what are we profited. And if one may be permitted to argue from the analogy of God's providence, as manifested in the works of nature, which of the innumerable seeds, both in the animal and vegetable creations, permits but comparatively few to come to perfection, we are led by the hand, as it were. to the conclusion, that of the vast amount of uncultivated intellect and rude genius which at any given age of the world, existed in the great mass of mankind, but a very minute and insignificant portion has been ripened to perfection for the use and advancement of man. We should no more tolerate the waste of intellectual power than of material wealth. I believe no better method could be devised to secure so important an object than the one we are now discussing—an universal system of examinations. The Society of Arts is prepared to aid in this good work with their utmost energy wherever an opportunity offers.

Nearly three years ago the question was formally brought under the notice of the Council in the report on Industrial Instruction. At the opening of the one hundredth session of our Society, Mr. Chester strongly recommended from this chair a general system of examinations to be established for the classes attached to our associated Institutions. The subject is growing in importance every hour. It was only a few weeks since that the Mechanics' Institution at Huddersfield held class examinations, apparently stringent, and showing a fair average amount of knowledge in the candidates. Our illustrious President, to mark his sense of the importance of such an example in this direction, presented the Huddersfield Institution with £25 to be distributed in prizes.

To encourage examinations of this kind, the Council propose to appropriate a considerable sum to be awarded in prizes to those Institutions associated with us, who shall hold, under certain limitations and conditions, the best sets of examinations within a certain period. The scheme when matured will be made public through the pages of the *Journal*.

There is yet another agency by which we desire to promote the interests of our Institutions. I refer to the establishment of *circulating libraries*, itinerating among groups of Institutions, or the associated societies of a county. The system of itinerating libraries has been for some years successfully in operation in the Yorkshire Union, in the Northern Union, in the Lancashire and Cheshire Union, and it has also achieved a great success in the Hants and Wilts Adult Educational Society, under the energetic and judicious guidance of the Hon. and Rev. Samuel Best and Mr. Wyndham Portal. To each of these groups of Institutions our Royal President has presented a box of books for circulation. Should any group of our associated Institutions desire the Society's aid in this matter, the Council will be prepared not only to afford every information which may facilitate the establishment of libraries of this kind, but also will be disposed to lend some material aid besides.

And now it is time that I should bring this somewhat tedious address to a close. Having said so much about ourselves, I will now say a little with reference to you. If we are to achieve any thing that shall hereafter be worthy, I will not say of recording, but even of remembering, it can only be effected by the close and cordial union of the Society of Arts with its four hundred associated Institutions. Unhappily we live in times when the still small voice of peace and her attendant train is lost in the din of arms. Our day is a witness of one of the great turning points of this world's history. Let us take care, even now more zealously than ever, that we shall not neglect to cultivate those arts which have made this country, an insignificant island on the outer verge of Europe, one of the great controllers of the destinies of the human race. There is yet another reason why we should cherish and uphold our Union. It has been said union is strength; so, too, union is power; association is one of the chiefest elements of success. Now of late years the ruling power in this country has gradually been transformed from a Government into an Administration. I express no opinion, I only state a fact. What I mean is, that no ministry in these times ever thinks of inaugurating a policy of its own, and standing or falling with it. The Administration conceives its duty to consist in carrying out, in legal phrase and constitutional form, those measures which the country demands. Consequently other measures, however pressing, essential, or beneficial, fall into abeyance, because, in commercial phrase, there is no demand for them. They must be pressed, nay, forced on the attention of the Government, or they will receive no attention. Look back at the legislation of the last five and twenty years, and ask how many of the great measures of reform which signalise that period would have been passed but for the pressure from without. I apprehend very few indeed. To agitate has become a privilege as constitutional as to petition. It is no longer branded as sedition. I do not believe that this is an unhealthy state of things;

those slight vibrations in the framework of society only establish its equilibrium; the fluctuations of the ocean do not affect its stabilty—they are the conditions of life for all within its bosom. Nor are those persons or parties who bring this external pressure to bear on an administration, or who use the screw, as the phrase is, therefore, looked upon as its opponents, for it feels that it can do nothing unless this pressure is brought to act upon it through Parliament or the public. Considered from this point of view, the close and intimate union of the Society of Arts with its four hundred Institutions becomes a matter of very grave importance. Their concerted action would be a powerful lever to move matters legitimately within their sphere. For example, the nomination of Mr. Tufnell's Committee for the distribution of parliamentary papers was entirely owing to the simultaneous action of the Mechanics' Institutions organised by the Society of Arts. I may remark, by the way, that the practical conclusions to which this Committee came lapsed, through Mr. Tufnell's much lamented death. We propose to try to induce the present Government to carry them out.

Time, that great innovator, has swept away many of those objects on which our Society set a high value during the first century of its existence. A second century is now open before us,—why should we not follow the example of time, and innovate by devoting our energies to those practical questions which press for a solution. We begin the century with many advantages over our founders. Political strife, if it has not altogether ceased, has been much allayed. The intercommunication of nations has been marvellously facilitated; erroneous principles of policy and vicious systems of trade have passed away. Moreover we have the benefit of their experience; their shipwrecks reveal to us the rocks and shoals we must avoid. If wisdom be the attribute of age, we should be wiser than they, for we have reached an older age of the world, and as we increase in knowledge we should also grow in wisdom. To those who project their thoughts into the uncertain future, it must be a matter of anxious solicitude, even though they be not dismayed by the reflection, that the onward progress of mankind has been once and again in the history of human advancement thrown back upon itself; to all such it must be a question of deep anxiety whether we shall afford another instance to verify the maxim of Polybius, that all empires, having attained to eminence hasten to decay, or whether a higher destiny may not rather be reserved for us, to spread the blessings of civilization—the fruits of an ennobled humanity—to give light to them that sit in darkness—to loose the chains of the captive—and to secure the liberties of mankind.

The Medals awarded at the close of the last Session for papers which had been read at the Evening Meetings, and for articles exhibited at the Society's Annual Exhibition of Inventions, or which had been submittted to the Society's Committees, were then distributed to Messrs. Atherton, Col. A. Cotton, Lawes, Dr. Royle, Sanderson and Simmonds in the former class, and to Messrs. Abate, Field and Son, How, Mackworth, W. Muir and Co. and Wenham in the latter category. A full list of these awards was given in Vol. III., page 589.

The Secretary announced that at the meeting of Wednesday, the 28th inst., the following Paper would be read:—"On the Gums and Resins of Commerce," by Mr. P. L. Simmonds. On this evening Dr. Lindley will preside.

Home Correspondence.

MR. LOSEBY'S PARALLEL RULE.

SIR,—As far back as the year 1821, Mr. Elliot, now Elliot and Sons, mathematical instrument manufacturers, made several equi-distant parallel rules for me, both with the simple link as well as with the micrometer screw and stops. I found, however, that the parallel joints of the ordinary rule are seldom correct, and when made so do not long remain true. I therefore adapted the micrometer screw and stops to the sliding wedge parallel rule, which completely answered my expectations. I afterwards found that in order to produce fine ruling and uniform tints, it was necessary to put the pen in a carriage running upon parallel bars, when the ruling became, of course, as perfect as that of the engraver's.

Mr. Webster's observations regarding the inaccuracy of Mr. Loseby's machine on account of the varying angle of the micrometer screw, are hypercritical, because it would never be used for very delicate and accurate divisions; and the imperceptible slip which always accompanies the trip-step movement, even in the sliding wedge form, wherein there is no angular defect, will ever render it unequal to any really exact work.

The cause which has prevented its general introduction is the facility with which mechanical draughtsmen in full practice will rule equi-distant lines by eye, and produce uniform tints quite true enough for all practical purposes, and will not harass themselves with a machine which requires so much manual dexterity.

My attempt, though original with me, was by no means the first, for I afterwards found that mechanical draughtsmen had long before been in the habit of fixing a link to their parallel rule for equi-distant parallel ruling, the first step towards producing the trip-step equi-distant ruling engine.

I enclose a sketch of my wedge-form equi-distant ruler, as it is very simple and inexpensive, but it should be observed that a necessary step towards perfection is to put the pen in a carriage running upon two bars parallel to the edge of the ruler.

There is a plate and description of a very complicated ruling engine, on the trip-step principle, for the use of engravers, in the former Transactions of the Society.

HENRY W. REVELEY.

Poole, Dorset, Oct. 19, 1855.

DECIMAL COINAGE.—THE TENPENNY SYSTEM.[*]

SIR,—May I beg a little space to remark that the question at issue between Mr. Rathbone and myself being one of *coinage* exclusively, that gentleman ought to have restricted himself in the discussion to making the most of his "tenpenny plan" *independently* considered, without appropriating to it, in addition, all the advantages belonging to *a system of weights and prices made to match*, by reckoning in its favour the apparent "saving of figures and labour effected by calculating at so much *per* 10*lbs.* instead of *per ton.*"

I observed in my letter of the 27th ult. (*Journal* Nov. 2nd), that "it would be a fairer comparison for Mr. Rathbone to make his calculation at 802 tenpences and 4 pence per ton, than at 13·5 pence per 10lbs." But of this he takes no notice, and likewise evades the question, *how to calculate without duodecimal division* the number of shillings and pence wanted to pay such sums as 17 tenpences and 6 pence, and 9 tenpences and 7 pence, while he merely informs us that the first *may* be paid with 10s., 4s., and 8d.; and the second with 5s., 2s. 6d., 6d., and 1d.

I have not seen his pamphlet of 1853, but my assertion as to the centesimal ratio is *confirmed* by his paper read before the British Association in last September. He there states:—"Three (moneys of account) were *vainly attempted* both in France and America; but the decimes of the former, and the dimes of the latter, have entirely disappeared, both as moneys of account and circulation."

Of course, I do not dispute the fact that calculations in a decimal system of coinage combined with a decimal system of weights and measures, would be simpler than they are at present. The greater part of Mr. Rathbone's letter might, therefore, have been omitted.

I remain, Sir, your obedient servant,
SAMUEL A. GOOD.

H.M. Dockyard, Pembroke Dock, Nov. 17, 1855.

RECOIL OF MORTARS.

SIR,—An ingenious mode of enabling mortars to recoil has lately been introduced, but what advantage is expected to result from this invention? Mortars have hitherto been fitted without recoil, and no mischief resulted from this mode either to large or small vessels. Sir Howard Douglas informs us that mortars were laid aside in favour of howitzers, but not, it would appear, on account of any bad effect of the mortars on large vessels; and in regard to small ones, no less than 14 ships' long-boats were armed with the largest mortars in use, fixed, without any carriage, so as to be fired point blank, or at small elevations, and did much execution to ships of the line in the year 1788.

I am, Sir, truly yours,
M. S. BENTHAM.

16th Nov., 1855.

Proceedings of Institutions.

BOLTON.—The thirtieth annual report of the Mechanics' Institution congratulates the members upon the acquisition of superior premises, which were inaugurated under the presidency of Lord Stanley, M.P. The committee express the hope that before any very long period has elapsed, they may be enabled to renew the suspended effort to obtain a new building. The number of honorary members is 61, and of general members, on the average of the four quarters, 193. Compared with the previous year, there has been a decrease of 3 honorary members and 29 general members. The number admitted by transferable cards has been the same, namely, 44. The balance-sheet shows the receipts from all sources to have been £310 19s. 1d., and the expenditure £332 15s. 9d., including a balance of £6 8s. due to the Treasurer on the previous account. The present deficit is thus seen to be £21 16s. 8d., and this, notwithstanding the receipt of £10, which the Committee of the Factory Workers' Bazaar generously placed at the disposal of the committee. A sum of upwards of £50 is also still required to meet the liabilities incurred in removing and fitting up the new premises. The reading and news-room has proved the most attractive portion of the Institution during the year. The number of volumes added to the library has been 128, being by purchase 102, and by donation 26. In addition, a considerable number of Parliamentary Reports has been presented by Mr. J. Crook, M.P. The number of volumes now in the library is 4,286. The total number of issues was 12.216 volumes, showing a decrease of 2,100 volumes, due to the suppression of issues during the time occupied in removing. Four boxes of books belonging to the Itinerating Library of the Institutional Association were also circulated for a short period. The classes have declined in efficiency. In addition to the two sections of the Elementary Class, numbering on an average 60 members—the Mechanical Drawing Class, averaging 19 members—and the Essay and Discussion Class, with an average attendance of 25 members—a Reading and Elocution class has been formed. The French class had to be discontinued owing to the inattention of the teacher, but efforts are being made to revive it. A Mutual Improvement Class has been in operation during the greater part of the year. The total number of members attending the classes has been 126. There have been three gratuitous lectures, two popular entertainments by Mr. H. Russell, and a concert by the English Glee and Madrigal Union.

NEWCASTLE-UPON-TYNE.—The seventh annual meeting of the Northern Union of Literary and Mechanics' Institutions was held in the library of the Mechanics' Institute, on the 31st ult. Earl Grey presided. The report commences by observing that the establishment of Mechanics' Institutes would have been incomplete without that reciprocity of intelligence which it is the principal object of this Union to disseminate. "The little village club, however zealously it is conducted by its humble officers, who laudably contribute their talents, their time, and their energies to its success, cannot achieve that success which is insured to it by a union with similar institutions. By such a union it becomes part of a great whole, important to society, to the nation, and to human nature itself. Not only is its power for good strengthened within its own sphere, but that power, otherwise limited, is extended in an incalculable degree; and the voice which speaks from an alliance of such Institutions will be heard with a degree of respect which no isolated body, however important in itself, can command." The idea which prevails in some quarters that Mechanics' Institutes have generally been failures, is thought to be incorrect, as "the improvement in the literature addressed to the working classes is a proof of the advancement of their taste and knowledge. A higher degree of talent is now necessary to insure popularity, and the best writers of the day are understood and appreciated by mechanics and labourers." Twenty five Institutions have been supplied from the Itinerating Library with a succession of twenty volumes every two months. By this plan societies with limited means are enabled to present their members, at a mere nominal cost, with a succession of new books, which could not otherwise have been obtained. H.R.H. Prince Albert has presented to the Itinerating Library 234 volumes of useful literature, handsomely bound in calf. Lord Brougham has also recently made a donation of valuable books to the same library; whilst Mr. Thomas Hedley has given seven boxes for transmission of the books from place to place. "From statistical returns made by twenty-four societies belonging to the Union, the total number of members last year was 2,443; the number this year amounts to 2,411, of which 63 are female members. It is much to be regretted that so few females avail themselves of the advantages afforded by such societies. Of newspapers taken in, 32 are daily, and 2 twice a week, and 164 weekly. The number of volumes in 23 societies was 32,061; the additions made this year are 1,079; making the total number of volumes in 23 societies 34,140. The circulation during the past year amounts to 44,060 volumes, forming somewhat more than an average of 18 volumes for each member. In connection with the Allenhead's Library and News-room, there had been formed a children's library, which is free to those children whose parents are members of the Institute, numbering at present 120 volumes adapted to juvenile tastes and capacity. This is a new and pleasing feature of a village library, and well deserves to be extensively imitated. The income of the above societies was £1,084 15s. 4½d.; the expenditure £1,068 17s. 3½d. It appears that the only institutions out of 24 that possess buildings exclusively their own, are Gateshead, and South Shields, in the county of Durham, and Haydon Bridge, in the county of Northumberland, and that a great many of the smaller societies have rooms granted for their accommodation free of charge. The free-holders of Framlington, in the county of Northumberland, have kindly offered for the use of the Institution of that place a free site, and it is to be hoped that the means for completing a new building will be speedily forthcoming. According to the returns, there are only 10 classes connected with the above-mentioned 24 Institutions; the Elswick Engine-Works Institution, however, have lately, in addition to their usual class, formed a class for mechanical and ornamental drawing, and with every prospect of success; the drawing classes connected with the South Shields Institution have for several years been in a flourishing state, the average attendance being 50 pupils, who pay a small fee each to the master, the remainder of the salary being defrayed out of the general funds of the Institution." * * * "From the reports made, it appears that 31 lectures have been delivered, 30 of these being gratuitous, and only one paid lecture. It would, therefore, appear quite evident, that the societies have not the means of engaging lecturers, and consequently it behoves the Union to afford every facility and advantage for gentlemen of ability, to devote their leisure to the instruction of the people in the pursuit of useful knowledge." The report then proceeds to state that, "It is a subject of deep regret to the council, that classes are not generally supported by Mechanics' Institutions. Evening schools especially, if properly conducted and supported, would be most advantageous to those whose education has been neglected. The council would earnestly urge upon the various committees the propriety of attention to this all-important question; indeed, few of the working classes can receive such an education at school as shall fully meet the requirements of after-life, and the experience of many men proves, that the most valuable because the most practical part of their knowledge has been gained after their education, as it is termed, had been concluded. It was to meet this deficiency in the means of the diffusion of knowledge, that Mechanics' Institutions were formed, and it appears absurd to neglect so obvious a means of attaining their object." The report concludes with the expression of the hope that Mr. W. Hutt, M.P., may be induced to take up and bring before Parliament, the question of the legal position of Institutes in reference to local taxation, which is at present in a most unsatisfactory and unsettled state. The report having been agreed to, it was proposed by Mr. R. INGHAM, M.P., seconded by Mr. H. G. LIDDELL, M.P., and carried unanimously, that an address be presented to H.R.H. Prince Albert, for his handsome donation. Various votes of thanks were then passed, the speakers being the MAYOR of NEWCASTLE, Mr. ROB, Mr. J. G. GRANT, Sir JOHN FIFE, the Rev. CLEMENT MOODY (Vicar of Newcastle), and the noble Chairman. Walker-upon-Tyne was selected as the place of meeting for next year, and the president of the Institute at that place, Mr. T. A. Cook, was elected president. After the delegate meeting a dinner took place, at which Earl Grey presided, supported by the Mayors of Newcastle and Gateshead, the Vicar of Newcastle, Messrs. R. Ingham, M.P., Hon. H. G. Liddell, M.P., P. H. Howard, J. Gray, Sir J. Fife, G. Crawshay, Lockey Harle, J. G. Grant, &c.; the vice chair being occupied by Mr. T. E. Headlam, M.P. A *soirée* followed the dinner. It should be mentioned that previous to the delegate meeting an exhibition of a general character was opened, comprising mechanical models of all kinds, and works of art, including specimens of photography, chromo-lithography, and nature printing, &c., &c.

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[*] This letter must close the controversy between Mr. Rathbone and Mr. Good.—ED. *Soc. of Arts Journal.*

Miscellanea.

PROPOSED UNION OF THE LITERARY AND SCIENTIFIC INSTITUTIONS OF CORNWALL.—A meeting has been fixed to take place in Truro, on the 27th inst., with the view of getting these institutions to act unitedly in the engagement of lecturers for the next spring course. The central committee have issued advertisements and letters to lecturers, asking for prospectuses and terms. The information so obtained is proposed to be communicated to each Institution six or seven days prior to the above meeting, and the delegates are expected to attend that meeting with full powers from their committees to decide and arrange for the course.

STORM SAILS.—A correspondent proposes for this purpose the substitution for the usual sail cloth alone intervals of net, the net to be made of the same width as the cloth, and placed alternately with it, and sewn together in the usual manner. He thinks that all the lower sails, with the exception of the jib and foresail, should be made in the above manner. In those he proposes that the width of the net should not exceed one-half that of the cloths, in order that the ship may answer to the helm the more readily. All the sails used above these might be made wholly of net.

MEETINGS FOR THE ENSUING WEEK.

MON.	Actuaries, 7.
	London Institution, 7, Mr. John Ella, "On Music, Vocal and Instrumental."
	Geographical, 8½, 1. Rev. G. L. Porter, "Memoir on the Map of Damascus, Hauran, and the Mountains of Lebanon;" 2. Rev. James Erhardt, "Reports respecting Central Africa, as collected in Mambara and on the East Coast, with a new Map of the Country."
TUES.	British Meteorological, 7, Captain Fitzroy, R.N., "On the Wind Charts published by the Board of Trade."
	Civil Engineers, 8, Mr. J. Baillie, "On the application of Volute Springs to the Safety Valves of Locomotive Boilers."
	Linnæan, 8.
	Zooloogical, 9.
WED.	London Institution, 3, Mr. Robert Bentley "On the Reproductive Organs and Classification of Plants."
	Society of Arts. 8, Mr. P. L. Simmonds "On the Gums and Resins of Commerce."
	Royal Soc. Literature, 8½.
	Archæological Association, 8½.
THURS.	London Institution, 7, Mr. W. Odling "On the First Principles of Mechanical Philosophy."
	Antiquaries, 8.
	Botanical, 8.
SAT.	Asiatic, 2.
	London Institution, 3, Mr. Thomas A. Malone, "On the Elementary Principles of Vegetable and Animal Chemistry."
	Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

It cannot fail to have been observed that the space occupied by the Patent matter has of late gradually increased so as widely to encroach on that required for other subjects. The commencement of a new volume is a convenient season for making a change, and henceforth the List of Patents will be published in the following form, which retains all that is essential for practical use.

[*From Gazette November* 16*th*, 1855.]

Dated September 8*th*, 1855.

2032. Robert Barnard Feather, Liverpool—Improvements in the make and construction of shells and balls to be used with cannon, or other artillery, or fire-arms.

Dated September 18*th*, 1855.

2104. James Dellagana, 61, Red Lion-street, Clerkenwell—Stereotyping type high, that is to say, as high as common printing type, or seven-eighths of an inch high.

Dated October 9*th*, 1855.

2269. Narcisse Leroy, 15, Rue de l'Eglise, Batignolles, Paris—Improvements in the construction of railway carriages.

Dated October 11*th*, 1855.

2273. William Andrew Fairbairn and George Haslam, Manchester—Improvements applicable to locomotive engines and carriages.
2275. Peter Spence, Pendleton—Improvements in the production of sulphate of alumina to be used in the fluid state, or to be rendered into the solid condition, known commercially as cake alum.
2277. John King Westrop, Staining-lane, and Edward Alfred Sharman, 35, Noble-street—Improvements in the manufacture of gloves made of looped fabrics of silk, cotton, and linen.

Dated October 12*th*, 1855.

2281. Robert Henry Kay and Alfred Thomas Richardson and George Mallinson, Manchester—Improvements in the manufacture of plain and ornamental woven fabrics.
2283. William Lyall, Amiens—Improvements in spinning machinery, applicable also to roving machinery.
2285. Henry Gardner, Oldner Farm, Chipping Norton—Improvements in machinery for dressing or cleaning wheat, grain, and seeds.
2287. Adolph Staadt, 3, Grande-place, Brussels—Improvements in obtaining motive power when gravity and steam or expansive fluids are used. (Partly a communication.)

Dated October 13*th*, 1855.

2289. Hugh Greaves, New Palace Yard—Improvements in the construction of steam-boilers.
2293. Louis Ullrich, Prague—Improvements in the means of indicating the number of persons entering an omnibus or other carriage, any theatre, or other building.
2295. Thomas and William Hemsley, Melbourne, near Derby—Improvement in the manufacture of embossed and craped fabrics.
2297. Manuel Perez Lozano, Crutched Friars—Improvements in treating pyrites and ores containing sulphur, in obtaining sulphuretted hydrogen, and in precipitating copper from solutions. (A communication.)
2299. John Stenhouse, 15, Upper Barnsbury-street, Islington—Improvements in the preparation of decolourising materials.

Dated October 15*th*, 1855.

2303. Samuel Kent, Liverpool—Improvements in purifying and measuring water, parts of which are applicable to measuring other fluids.
2305. James Miller Brown and Thomas Brown, 165, Piccadilly—Improvements in the manufacture of folding chairs.

Dated October 16*th*, 1855.

2307. Lewis Normandy, 67, Judd-street, Brunswick-square—Improvements in the mode of writing and printing music, to facilitate the study thereof. (A communication.)
2311. Edwin Wilkinson, Woodhouse, York—Improved mode of extracting grease from woollen, cotton, and worsted waste.
2313. William Edward Newton, 66, Chancery-lane—Improvements in the construction of fire-arms. (A communication.)
2315. James Fraser, Jermyn-street—Improvement in the manufacture of paper or paper pulp. (A communication.)

Dated October 17*th*, 1855.

2317. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of anchors.
2319. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of railway bars.
2320. William Thomson, Perth—Improvements in four-wheeled carriages.
2321. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of cast steel.
2322. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in metal beams, girders, and tension bars, used in the construction of roofs, floors, and other parts of buildings, and in the construction of viaducts and suspension and other bridges.
2325. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of ordnance, and in the projectiles to be used therewith.
2327. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of railway wheels.
2329. John Talbot Pitman, 67, Gracechurch-street—Improvement in fire-arms. (A communication.)
2331. John Adcock, Marlborough-road, Dalston—Improved apparatus for measuring and indicating the distance travelled by ships or other vessels.

Dated October 18*th*, 1855.

2333. Charles Edwin Jones, Huddersfield—Improvements in machinery for raising water and other liquids by means of a combination of the principle of the accumulation of force, by compression of air or other elastic fluids, and that of centrifugal force, the more readily to obtain increased mechanical power thereby.
2335. William Glass, 2, Dahlia-cottages, Millwall, Poplar—Improvements in obtaining a deodorising and disinfecting material.
2337. Doctor Graham, Over Darwen—Improvements in the manufacture of paper hangings and in machinery to be used in such manufacture. (A communication.)
2339. John Cheesman Wagstaff, 20, Grosvenor-street—Improvements in the manufacture of seamless garments and other seamless fabrics. (Partly a communication.)

Dated October 19*th*, 1855.

2341. John Smith, 32, Brydges-street, Covent-garden—Improvements in the construction of bedsteads, such improvements being applicable to carriages, ambulances, and other articles.
2347. Henry Giller, Southampton-street—Improvements in globes and shades for gas and other lights.
2349. William Field and Edward Jeffreys, Shrewsbury—Improved means for securing the rails of railways in their chairs or bearings.

Dated October 20*th*, 1855.

2351. Pierre Arnaud Massip, 39, Rue de l'Echiquier, Paris—A machine for preparing hat linings. (A communication.)
2353. Nathaniel Shattswell Dodge, St. Paul's-churchyard—Improvements in machinery or apparatus for spreading or distributing water-proofing or similar compositions over webs or sheets. (A communication.)
2355. Frederick Whitaker, Murray-street, New North Road—Improvements in the construction of sewing machines.
2357. Henry Woodrow, Wood-street, Cheapside—Improvements in shirts.

Dated October 22*nd*, 1855.

2363. Vincent Scully and Bennett Johns Heywood, Dublin—Improvements in clips or holders for suspending railway tickets, and other small articles.

Dated October 23*rd*, 1855.

2365. William Wilson, Manchester—Improvements in machinery for crushing grain and other substances.
2367. Adolphus Oppenheimer, Manchester—Improvements in machinery or apparatus for stretching or distending velvets and other piled goods or fabrics for the purpose of cutting the pile of such goods.
2371. Thomas Richardson, Portland-place, Newcastle-on-Tyne—Improvements in the manufacture of glass and clay wares.
2373. Henry Weber, Zurich—Improvements in apparatus for motive power.

Dated October 25*th*, 1855.

2377. Jacques Rives, 53, Boulevard St. Martin, Paris—Improvements in looms for weaving.
2379. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in lamps. (A communication.)
2381. John Edward Mayall, 226, Regent-street—Improvements in photography.
2383. Charles Crickmay, Lambeth, and Frederick Joseph Clowes, Camberwell—Improvements in the manufacture of guns, pistols, and gunstocks, and in cutting and carving wood, metals, and minerals, and other materials by machinery.
2385. Eugène Hippolyte Rascal, Catherine-street, Strand—Improvements in apparatus used in the manufacture of type and other articles for letter-press printing. (A communication.)

Dated October 25*th*, 1855.

2387. Henry Tritton, Great Grimsby—An improved safety apparatus for the protection of persons while painting the exterior of buildings and cleaning windows, which may be used as a balcony for holding flowers.
2389. James Platt and John Whitehead, Oldham—Improvements in machinery or apparatus for preparing clay for the manufacture of bricks.
2391. John Andrew Richards, 10, Tyers-gateway, Bermondsey-street—Improvements in producing the 'hard grain' on leather.

Dated October 26*th*, 1855.

2392. John Pinches, Oxendon-street, Haymarket—Improvements in the construction of dies or stamps for marking papers, linen, or other substances.
2395. Edwin Pugh, Charham, Kent—Safety alarum and signal apparatus.

Dated October 27*th*, 1855.

2399. Simon O'Regan, Liverpool—Improvements in marine engine boilers, and other boilers and their furnaces.
2401. John Ashton, Oldham—Improvements in certain parts of machinery known as 'self-actors' (employed for spinning and doubling cotton and other fibrous materials), for more effectually crossing the yarn during the shaping or building of the 'cops,' than heretofore.
2403. Peter Cranke Wood, Guilford-street-east—Improved machinery for preparing or scutching flax, and other analogous fibrous substances. (A communication.)
2405. Edwin Tomlinson, Barns Cray, Crayford, and Alfred Mortimer Job, Islington—Improvements in waterproofing skins of animals.
2407. Alfred Able, Spring-street, Sussex-gardens, Hyde-park—Improvements in stopping, filling, or plugging teeth, and in instruments to be used therefor.

Dated October 29th, 1855.

2416. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in breaks for railway carriages. (A communication.)

Dated October 31st, 1855.

2424. Robert Griffiths, Lower Broughton, Manchester—A compound and exact measurement tap, applicable to the measurement of every kind of liquor or liquid.
2426. Thomas Webster Rammell, Trafalgar-square—Improvements in preparing black lead, chalk, and other materials used for drawing, writing, and marking.
2428. George F. Woolston, Washington, U.S.—Improvements in cutting and planing wood.
2430. Thomas Shipp Grimwade, Harrow—Improvements in treating milk in order to preserve it.
2432. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the manufacture of gas. (A communication.)

Dated November 1st, 1855.

2434. Henry Barber Beaumont, 11, Gloucester-terrace, Hyde-park—Improvements in portable dwellings or huts, vehicles, and boxes, or packing materials for travellers.
2436. Richard Reeves Cox, Fareham—Improvements in the manufacture of artificial fuel.
2438. David Louis Antoine Nicole, 16A, Chichester-place, King's-cross—Improvements in apparatus for winding up watches.
2440. John Pinches, Oxendon-street, Haymarket—Improved machine or apparatus for embossing paper, metal, and other substances by hand.
2444. Lewis Normandy, 67, Judd-street, Brunswick-square—Improvements in securing the rails in railways. (A communication.)
2446. Edwin Thomas Truman, Old Burlington-street—Improvements in palates or holders for artificial teeth.

Dated November 2nd, 1855.

2448. John Cottrill, Great Lever, near Bolton—Improvements in machinery or apparatus for washing, scouring, dyeing, sizing, and cleaning woven fabrics and yarns.
2450. John Patterson, Beverley—Improvements in mills or machines for grinding, crushing, cutting, and hulling or shelling various kinds of farm produce, and also for crushing and grinding minerals and other substances.
2452. Werner Staufen, 9, Baker street, Portman square—A substitute for hair and other substances commonly employed for stuffing cushions, furniture, and other articles.

Dated November 3rd, 1855.

2456. James Smith Cottrill, Great Lever, near Bolton—Improvements in machinery or apparatus for washing, scouring, dyeing, sizing, and cleaning woven fabrics and yarns.
2458. James Eastwood, Mill House, Midgley, York—Certain machinery or apparatus for taking out the slubs, noils, and knots from worsted sliver, slubbing, and roving.
2460. George Davis, Southampton—Improvements in apparatus for letting in or shutting off water or other liquids.
2462. William Robertson and James Henry, Edinburgh—Improvements in machinery for reaping and mowing corn or other agricultural produce.
2464. James Greenshields, Glasgow—Improvements in the manufacture or production of drying oleaginous compounds.
2466. William Gardner, Droylesden—Improved method of manufacturing watches or other timekeepers, and also improvements in the machinery, tools, or apparatus for accomplishing the same.
2468. Fennell Allman, Cambridge-terrace—Improvements in apparatus for the production of steam.
2470. George Collier, Halifax—Improvements in weaving carpets and other pile fabrics.
2472. Richard Archibald Brooman, 166, Fleet-street—Improvements in generating motive power. (A communication.)

Dated November 5th, 1855.

2474. John Hicks, Bedford-place, Clapham-rise—Improved gauge valve, applicable to boilers of steam-engines, and to other purposes.
2476. Francis Hawkes, sen., West-street, Reading—Improvements in the construction and arrangement of water-closet apparatus.
2478. Henry Clinton Page, 1, Commercial-road-south, Pimlico—Improved method of indurating marble and stone, and of permanently fixing colours therein, when colouring matters are applied thereto for producing a variegated pattern or device on the surface thereof.
2480. Maurice Gillemot, Paris—Improvements in stopping horses.
2482. Peter McGregor, Dumbarton—Improvements in water-closets.
2484. Thomas Thomas, jun., Bristol—Improvements in the manufacture of soap.
2486. Alexander Charles Louis Devaux, King William-street, City—Improvements in the construction and the fitting up of granaries.

Dated November 6th, 1855.

2488. Joseph Jessop, Lascelles Hall, near Huddersfield—Improvements in the construction of furnaces and boilers.
2490. Richard Goose, Birmingham—Improvements in the manufacture of cut nails.
2492. Richard Threlfall and John Higson, Preston—Improvements in machinery or apparatus used in preparing or sizeing and dressing yarns for weaving.
2494. Anthony Dugdale, Rue Ponthieu, Paris—Improvements in the construction of locomotive engines applicable in part to marine and stationary engines.

Dated November 7th, 1855.

2496. George Cotsell, Brompton—Improved gutter and kerb for roads and streets.
2498. Charles Hart, Wantage—Improvements in threshing and dressing machines.
2500. Frederick Scholefield, Manchester—Improvements in machinery or apparatus for cutting paper, card-board, and similar materials.
2504. Louis Benoit Advielle, Paris—Improved process for silvering metallic articles.
2506. John Wakefield, Inchicore Works, Dublin—Improvements in machinery for working the slides and steam valves of engines driven by steam or other elastic fluid.
2508. Charles Marie Pouillet, Paris—Improvements in railways.
2510. Thomas Godding, Ipswich—Improvements in the fastening for stays, corsets, and bands.
2514. Charles William Siemens, Adelphi—Improvements in evaporating brine and other liquids, and in distillation.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2519. Cullen Whipple, U.S.—Improvements in machinery for preparing and combing fibrous materials.—8th November, 1855.
2533. Ephraim Green and Jacob Green, West Bromwich—Improvements in malt crushers.—10th November, 1855.

WEEKLY LIST OF PATENTS SEALED.

Sealed November 16th, 1855.

1108. Robert Vezey and Edmund Vezey.
1118. James Rae.
1125. William Henry Dearing Granville.
1126. Robert John Stainton and Edmund Charles Davey.
1134. Thomas Piggott.
1139. Ignace Joseph Silbermann, jun.
1145. William Mac Naught.
1147. James Shanks.
1149. John Henry Johnson.
1151. Henry Emanuel Scott.
1180. George Horrocks.
1199. Charles Weightman Harrison.
1230. George Rogers.
1264. François Celestin Armelin, jun.
1298. Pierre Antoine Favre.
1306. Charles Constant Joseph Guffroy.
1308. Richard Peters.
1344. John Charles Brant.
1361. Felix Leloup.
1402. John Henry Johnson.
1433. John Gay Newton Alleyne and Henry Strafford.
1440. Stanislas Tranquille Modest Sorel.
1490. William Woodcock.
1588. Edwin Senior Atkinson.
1608. Walter Christopher Thurgar.
2098. James Tennant Caird.

Sealed November 20th, 1855.

1127. Walter Henry Tucker.
1137. Harry Whittaker.
1164. William Smith.
1172. Charles Rawlings.
1210. Samuel Rowlands.
1226. Edward John Payne.
1228. William Langshaw and George and William Jelley.
1292. George Hopper.
1320. Masta Joscelin Cooke.
1460. François Vennin Deregniaux.
1640. Henry Duncan Preston Cunningham.

WEEKLY LIST OF PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

November 12th, 1855.

738. Richard Coad and John Peers Coad.
787. Moses Poole.
795. Henry Bessemer.
797. Henry Bessemer.
799. Henry Bessemer.
820. Samuel Hunter.
900. Samuel Cunliffe Lister and James Warburton.

November 13th.

754. William Fraser Rae.
755. James Robertson.
876. Jean Hippolyte Salvan.

November 14th.

748. Constant Jouffroy Dumery.
762. Joseph Burley.
767. John Rambsbottom.

November 16th.

863. James Nasmyth.
871. James Taylor.
1094. Alfred Krupp.

November 17th.

790. Benjamin Nickells.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 30, 1855.

SECOND ORDINARY MEETING.

WEDNESDAY NOVEMBER 28, 1855.

The Second Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 28th inst., Dr. Lindley, F.R.S., in the chair.

The paper read was:—

THE GUMS AND RESINS OF COMMERCE.

By P. L. SIMMONDS.

The subject which I have undertaken to open up for discussion this evening is one embracing so many important articles of commerce, and extending over so wide a field of research, that I can scarcely hope to do common justice to any even of the great classes into which it naturally divides itself—much less to enumerate or particularise one-half of the various new gums and resins which I should desire to bring more prominently into notice. Any one of these gums or resins would have formed ample field for investigation and inquiry of itself, taking it in its several relations of origin, sources of supply, mode of procuring, quantity obtainable, price, chemical composition, and probable utility, as compared with other similar exudations and their commercial uses.

But in taking a rapid survey of the whole group of gummy and resinous exudations, any such close and full description would be utterly impossible—and as it is, I shall have to pass over much of the information I have arranged, leaving it for the quiet perusal and future consideration of those who feel greater interest, in its more extended form in the columns of the Society's *Journal*.

In the mode of treating my subject I hesitated at first as to whether it might not be useful to go over each quarter of the globe separately, giving distinct accounts of the gummiferous plants and products of Europe, Africa, Asia, Australia, and America. But on reflection I found that this would entail much repetition, and I am, therefore, necessitated to fall back on the conventional classification usually adopted of true gums, resins, gum resins, oleo resins, and elastic gums, and I hope to be able to furnish something new to our current stock of information under each of these heads.

The importance of this class of commercial products will be better estimated by the statistics I shall be able to furnish of the trade, brought down to within the last year or two.

That there has long been a want of some more detailed information on the gums and resins of commerce will not be denied, for, although much has of late years been done by the several local and metropolitan exhibitions to collect and diffuse correct information, we are still lamentably deficient in details as to the plants that produce very many; and the learned Professor who presides on this occasion, knowing himself how difficult it is to identify plants without the presence of the leaves, barks, and necessary adjuncts, will readily be able to excuse any accidental errors I have fallen into, which his more experienced judgment may be able to correct. Much information respecting the gum-bearing trees of commerce and their products is doubtless to be found scattered through many home and foreign scientific periodicals, but this bears rather on their medicinal value than on their commercial properties and uses in the arts and manufactures, and grave errors continue to be propagated in standard works from day to day; even in a publication of weight and influence like the "Encyclopædia Britannica," most of the details in the articles as given in the new edition (as far as it has proceeded,) are nearly reprinted verbatim as issued in its pages some thirty or forty years ago.

There is another work of assumed authority, where one would naturally look for some recent information as to the progress of discovery in new gums and their applications, viz., Dr. Ure's Dictionary of Arts and Manufactures, but in the last edition of 1853, the article "Gums" stands verbatim as it did in the editions fifteen years previous, brief and meagre in its character, while that on Resins has merely an addenda of a page to the previous stereotyped matter.

Everyone who brings the result of his researches and investigations to bear into the common stock, if he has been diligent and treated the subject fully and fairly, must contribute some few hints that may prove useful, and if I but succeed in doing this, I shall be satisfied.

I must premise that in order to assimilate my information to the erroneous nomenclature of city circles and commercial lists I am obliged to depart to some extent from the true scientific definition, and shall speak frequently of many substances as "gums" which are properly gum resins, or pure resins. Were I not to do this I should confuse many of those whom I see around me, and who have had to buy and sell by names which were erroneously given years ago, before chemical analysis had determined the true composition of many.

It has been well observed by Professor Solly (Jury Reports, p. 71), that "a great deal of practical inconvenience and confusion is caused by the indiscriminate manner in which the term *gum* is used in commerce and the arts. It would certainly be an advantage if the distinctions employed in scientific books were to be generally adopted by merchants and drug-brokers, the term gum being solely applied to those natural vegetable exudations which soften or dissolve in water, and yield a more or less perfect mucilage, but which are wholly insoluble in spirit; the term *resin* being applied to those fusible and combustible vegetable substances which are quite insoluble in water, but which soften and dissolve in ether, the 'essential oils,' and 'spirits of wine,' and the term *gum resin* being used to designate those mixtures of gum and resin which are intermediate in properties, and partake of the nature of each, being partially and imperfectly soluble both in water and in alcohol."

Gum, properly so called, is used in large quantities for a number of purposes in the arts. It is generally distinguished into soluble gum, or gum arabic, which readily and perfectly dissolves in water, forming a clear mucilage, and cherry-tree gum, or gum tragacanth, and those difficultly-soluble kinds of gum, which, though they soften easily, do not readily form mucilage. Gum is extensively used in finishing and giving lustre to crapes, silk goods, &c., by calico printers, shoemakers, and in other trades.

As instances of the immense traffic carried on in gums, I may state that one Liverpool firm imported in three years Gum Senegal to the value of £100,000. Gums to the value of 3¼ millions of francs have been shipped annually from Alexandria. The exports from Morocco reach to 250 or 300 tons, and India exports 1,500 or 1,600 tons.

The GUM ARABIC of commerce is the produce of various species of acacia, which yield this substance in considerable quantities, particularly *A. vera*, a native of Arabia and of Africa, from Senegal to Egypt, which supplies the finest qualities; *A. Arabica*, a smaller tree, common in India and Africa, which yields part of the Turkey and East India gum; the red pieces constituting the gum gedda and gum babool of commerce.

A. gummifera, a high, thorny tree, found near Mogador, the coast of Guinea, and in Arabia, furnishes what is known as Barbary gum, a darker variety.

A. Senegal yields part of the Senegal gum, the tears of which are usually in larger masses than *arabic*, of a darker colour, and more clammy and tenacious. The trade in this variety is chiefly in the hands of the French, and we have imported supplies occasionally from France.

In the Cape colony gum is collected by the Kaffirs from a species of Acacia closely resembling *A. vera*, which Burchall, in his "Travels into the Interior," calls *A. Capensis*, the *A. karoo*, probably, of Hayne, Nies, and Ebermaier, which is abundant on the banks of the Orange River. It is of a pale yellow colour, and is not considered by the dealers so good as that obtained in the more northern parts of Africa.

The ordinary Cape gum of commerce exudes spontaneously from the bark both of the trunk and branches of the thorn tree (*Acacia horrida*, Willd).

A considerable trade was carried on by the Cape colonists a few years ago with Kaffirland for the gum gathered from the Mimosa tree. Waggon-loads were constantly being sent off to Port Elizabeth for shipment to the London market. It was extensively used by calico-printers, calenderers, makers of stationery, and in various industrial arts. The exports have declined from 4,876 cwts. in 1849 to 72 cwts. in 1853. The reason for this decline is curious. By mere accident it was discovered that a gum could be manufactured from potatoes or wheat. This article—now called British gum—dextrine, or gum substitute, has superseded the more expensive in almost every department of manufacture and art in which it was used—hence the demand for Kaffir gum is at an end. British gum is found to possess adhesive properties equal to Gum-arabic, being less liable to be affected by climate, it is therefore used for postage-stamps, envelopes, &c., as well as in manufactures, and it can be produced for less than one-fourth the cost.

Some fortunes have been made by the discovery, which originated in pure accident, and which is stated to have been made as follows:—

A fire took place in a manufactory of starch from potatoes, near Dublin. The burning building was deluged with water from the fire-engines, and the starch washed about in every direction. A man fell down into the flood of calcined starch and water, but thought no more of it until next morning, when dressing himself he found the legs of his trowsers, sleeves of his coat, pockets, and every other opening firmly obstructed. On examination he thought he had fallen into gum, but on revisiting the scene of the fire he discovered that the properties must be contained in the potato starch, and by a few simple experiments he made a discovery which has resulted in large profits.

According to the statement of Dr. Vaughan, of Aden the acacia which yields gum arabic is generally a small shrub, of a dry and withered appearance; occasionally, however, it shoots out into a tree of from twenty to thirty feet high. The Somalis, on the north-east coast of Africa, collect the gum during the months of December and January. The process of obtaining it is extremely simple; long incisions are made in the stem and branches, from which the juice flows, and when dry is removed After the gum of a district has been gathered, it is sewn up in goat skins, and brought on camels to the great Berbera fair, or to some of the smaller settlements on the coast, and thence shipped to Aden and India.

There are three descriptions of the gum, styled severally Felick, Zeila, and Berbera. None of the first-named, which is esteemed the best, finds its way to Aden, the mass being usually bought up by the Banians, or Hindoo merchants, and shipped direct to Bombay, where it realises about 50s. the cwt. The other two named varieties are called after the ports of shipment, and only fetch about half the price of the Felick gum. In 1851, 250 tons of gum-arabic passed through the Aden custom-house, the selling price there being about 24s. the cwt.

The local names for the gum-arabic, or Summuk, are adad, wadi, and anhokib, of which the anhokib is considered the best. It sells at Bunder Murrayeh for 1½ dollars per frasila of 20lbs. The tree is found on the mountain sides, in good red soil, and varies in height from ten to twenty feet. The inferior qualities of gums are sold at a much lower rate.

During the hot season the men and boys are daily employed in collecting gums, which process is carried on as follows:—About the end of February or the beginning of March, the Bedouins visit all the trees in succession, and make a deep incision in each, pulling off a narrow strip of bark for about five inches below the wound. This is left for a month, when a fresh incision is made in the same place, but deeper. A third month elapses, and the operation is again repeated, after which the gum is supposed to have attained a proper degree of consistency. The mountain sides are immediately covered with parties of men and boys, who scrape off the large clear globules into one basket, whilst the inferior quality that has run down the tree is packed separately.

The gum when first taken from the tree is very soft, but hardens quickly. Every fortnight the mountains are visited in this manner, the trees producing large quantities as the season advances, until the middle of September, when the first shower of rain puts a close to the gathering of that year. Large quantities of gum-arabic are collected by persons in the employ of the Egyptian government, and brought to Cairo in the caravans to be warehoused. The annual return occasionally reaches to 20,000 packages of 78 lbs. each.

In Morocco, about the middle of November, that is, after a rainy season, which begins in July, the gummy juice exudes spontaneously from the trunk and principal branches of the acacia tree. In about fifteen days it thickens in the furrow, down which it runs, either in vermicular (or worm) shape, or commonly assuming the form of oval and round tears, about the size of a pigeon's egg, of different colours, as they belong to the white or red gum tree. About the middle of December the Moors encamp on the border of the forest, and the harvest lasts six weeks.

The gum is packed in very large sacks of leather, and brought on the backs of bullocks and camels to certain ports, where it is sold to the French and English merchants. It is highly nutritious. During the time of harvest, of the journey, and of the fair, the Moors of the desert live almost entirely upon it, and experience proves that six ounces of gum are sufficient for the support of a man twenty-four hours.

Gum is largely collected in Central Africa, and sent to the coasts of the Mediterranean and the oceans. Gum-arabic and Senegal to the value of £120,000 are exported; other sorts of gums to the value of £12,000, and resins and varnishes to the value of £6,000. From Senegambia the quantity of gum exported is given at 25,000 quintals or cwt., of which 9,000 go to France, 6,000 come to this country, 4,000 go to Portugal and the United States, and about 6,000 are sent by the caravans of Fezzan and Morocco to other parts of Central Africa.

In the Indian bazaars, the products of a variety of trees are mixed and indiscriminately vended as gum by the native druggists. Among them are gum from the neem, the mango, the babool, (*A. arabica*), *Cassia auriculata*, cotton-tree, and several others. They are much inferior, however, to the gum of the *Acacia vera*.

A large quantity of excellent gum is procured in the East from the wood apple (*Feronia elephantum*), which much resembles gum arabic in its chemical and serviceable proportions, and from its ready solubility it gives the best mucilage for making black ink.

Dr. Wight tells us that good gums are obtained by the natives of Coimbatore from the following plants:—*Aegle marmelos*, *Prosopis spicigera* and *Acacia sundra*; and very fair kinds from *Melia azadirachta*, *Acacia odoratissima Conocarpus latifolia*, *Soymeda febrifuga*, *Odina Wodier* and some others.

The bastard ebony tree of Central India, and also many other of the forest trees which abound there, yield large quantities of rich and valuable gums. Dr. Spry collected as many as fifteen varieties in one locality.

There are more than 180 species of the acacia in Australia, and from them exudes the purest gum-arabic. It is so plentiful that at particular periods several pounds may be collected in some places in an hour or two. It possesses all the good properties of the gum from Arabia, and is used successfully for the same purposes in the colony. The *Acacia Senegal* or *Mimosa Senegalensis*, a tree rising fifteen to twenty feet high, affords the Senegal Gum of commerce, which does not differ essentially from the gum of *Acacia vera*, except in the shape, and being somewhat less soluble. In 1849 we imported 5.696 cwt. of gum-senegal direct from Senegambia, and 256 cwts. from Morocco, whence the imports in 1853 reached to 2.838 cwt. In 1840, we imported 601 cwts. from the Gambia, and in 1851, 850 cwt. of gum-senegal, but none in subsequent years. In the Algerian collection at Paris, mention is made of Mesteba, an indigenous gum of Northern Africa, of which little seems to be known, except that it forms an article of traffic at the markets of the oases in the Algerian desert.

Another white gum, called Aourouar, is also spoken of, and which is said to be shipped to England by the way of Souira; a darker gum yielded by a tree called toleukh, is brought by the caravans from Timbuctoo. These are probably some of the darker and less valuable gum-arabics which come into commerce under the name of Barbary and other gums.

Mezquite Gum.—Attention has recently been called in the United States to the discovery, in great abundance, of a species of acacia, known as the mezquite tree, which furnishes large quantities of gum, nearly equal to the gum-arabic of Africa. It will no doubt prove a valuable source of revenue to the State of Texas, New Mexico, and the adjacent Indian territory, besides affording employment to the different tribes of Indians, now roving upon the plains, many of whom would be glad to gather and deliver it to the different frontier government posts for a very small compensation.

The mezquite is by far the most abundant tree of the plains, covering thousands of miles of the surface, and always flourishes most luxuriantly in elevated and dry regions. The gum exudes spontaneously in a semi-fluid state from the bark of the trunk and branches, and soon hardens by exposure to the atmosphere, forming more or less rounded and variously-coloured masses, weighing each, from a few grains to several ounces. These soon bleach, and whiten upon exposure to the light of the sun, finally becoming nearly colourless, semi-transparent, and often filled with minute fissures. Specimens collected from the trunks of the trees, were generally found to be less pure and more highly coloured than when obtained from the branches.

The gum may be collected during the months of July, August, and September; but the most favourable period for that purpose is in the latter part of August, when it may be obtained in the greatest abundance, and with but little trouble. The quantity yielded by each tree varies from an ounce to three pounds; but incisions in the bark not only greatly facilitates the exudation, but causes the tree to yield a much greater amount. As it is, a good hand will probably be able to collect from ten to twenty pounds in a day. Were incisions resorted to, double the amount might be obtained.

A simple, pure gum, was recently shown at Madras, obtained in Travancore, from the *Macaranga indica*, which has been used for taking impressions of leaves, coins, medallions, &c. When the gum is pure and carefully prepared, the transparent impressions are as sharp as those of sulphur, without its brittleness. The exudation appears to be an entirely unknown production.

Keekur gum, a variety of Arabic, is produced by *Vachillia farnesiana*. *Acacia Sirissa* in India yields a large quantity of a clear gum known as Dirisani gum, and closely resembling Keekur gum. Booraga, obtained from *Bombax malabricum*, is a pure gum.

Tragacanth is a gummy exudation, obtained from various species of *Astragulus*; *A. verus* (Olivier), *gummifera creticus* (Lamarck), which is imported for medicinal purposes from Smyrna and other ports in the Levant, to the extent of about five or six tons per annum. It is obtained principally from Northern Persia, Asia Minor, and America. Hamilton (Researches in Asia Minor, &c.) states that tragacanth, which is called by the Turks "kittereh," is collected in large quantities in the hills about Buldur, from a low prickly plant, resembling a species of furze. The white flaky gum is obtained by making an incision in the stem, near the root, and cutting through the pith, when the sap exudes in a day or two and hardens in the opening, after which it is collected by the peasants. Its price there was about 3s. 2d. per lb. 23 tons were imported in 1850 from Smyrna, and the imports have since annually increased, until in 1853 they reached nearly 70 tons.

A spurious tragacanth is obtained in the East from the *Sterculia urens* and *S. fœtida*, and an inferior tragacanth is also procured from *Cochlospermum gossypium*.

Leaving the true gums, we come now to the Resins. These are either natural exudations or are obtained from some vegetable compounds by the aid of alcohol, in which they are generally soluble, although totally insoluble in water. They are for the most part brittle, tasteless or insipid, fusible at a moderate heat, soluble in the fixed and volatile oils, and some in the muriatic and acetic acids. They have no smell, except when they retain a portion of volatile oil, in which case they partake of the smell and acid taste of that oil. Resins generally burn with a strong yellow flame, emitting at the same time a vast quantity of smoke. Dammer affords a good example of the resins.

It is strange that of the origin of substances at once so valuable and so familiar to us so little should be known. The sources of the dammer and many of the wood oils from Singapore and the Eastern Archipelago are little known, nor are the copals, the anime, the myrrhs, and other valuable gums and resins from Africa, Zanzibar, &c., well defined.

Colophony, the ordinary resin of commerce is the residuum remaining in the body of the still after common turpentine has been submitted to distillation for the manufacture of the oil of turpentine of commerce, or spirit of turpentine. The black resin, or colophony is the cooled brittle mass in the state in which it leaves the still; the amber, or yellow-coloured, is the same resin mixed with about one-eighth part of water while it is yet fluid.

Large quantities of resin oil, or pine oil, as it is generally called, are made in the metropolis and in the neighbourhood of Liverpool, Hull, Bristol, and Glasgow, and it is employed in the manufacture of grease for lubricating the bearings of heavy machinery, and the axles of railway waggons, &c. It is much used in France for the manufacture of printing-ink, and hence a principal source of the unpleasant odour of some of the French newspapers. About 23,000 tons of rosin are annually imported, of which the bulk comes from America, and a little from the Hanse towns.

One of the most important oleo-resins in a commercial point of view is Turpentine, of which we import from 17,000 to 25,000 tons per annum, almost exclusively from the United States. The comparative receipts in the last nine years have been as follows:—

	Tons.		Tons.
1846	17,897	1851	21,790
1847	16,193	1852	24,080
1848	20,089	1853	19,650
1849	20,666	1854	17,088
1850	21,731		

In the State of North Carolina, about 800,000 to 1,000,000 barrels of turpentine are now annually made, giving occupation to about 5,000 labourers in making it, and perhaps three times as many more human beings are supported mainly from the proceeds of its first sale. There are about 200 stills in operation there. The income of North Carolina from her pineries alone must reach half-a-million sterling.

The multifarious uses of the pine tree seem to augment with the development of the inventive talent and ingenuity of the age. Manufacturers already extensively use it in various processes. The painter draws deeply upon the turpentine to paint the four million of dwelling houses in Great Britain and the same number in the United States, besides the carriages and other vehicles. That great lever of public opinion, the press, could not put forth a printed page without it. Turpentine to the value of £50,000 or £60,000 is annually consumed in America by the Indian-rubber manufacturers. The new process of lighting up houses and whole cities with rosin-gas in America is consuming every barrel made, and has greatly raised its price there. The soap-maker, too, has long used it, and could not now dispense with it.

A liquid resinous exudation known as Chiam or Cyprus turpentine is obtained in Syria and the Greek Archipelago from *Pistacia Terebinthus*. The trunks of the largest trees are cut across with a hatchet, and the turpentine runs down on flat stones placed for the purpose, where it hardens. The quantity obtained from each tree is only about eight or ten ounces.

The coniferous trees of Europe and America furnish the turpentine, tar, and pitch of commerce, especially in Europe, *Pinus Sylvestris*, and *P. Pinaster*.

The swamp or long leaved pine supplies the chief portion of the turpentine, tar, &c., consumed in or exported from the United States. *P. Tæda*, abundant in Virginia, yields common turpentine, but of a less fluid quality than that which flows from the preceding species.

The resins are chiefly used in making varnishes and lacquers, for several purposes in dying, for sealing wax, and for ornamental house papering.

Varnishes may be divided into three classes, spirit varnishes, volatile oil varnishes, and fixed oil varnishes. The first class are easily prepared and applied, dry quickly and are free from unpleasant smell; they are used for articles of furniture and musical instruments.

The resins which enter into their composition are seedlac, benzoin, anime, or Thus. The varnishes made with essential or volatile oils are chiefly used for pictures—caoutchouc, and oil of turpentine, (turps, as as it is familarly termed), enter into their composition. Fixed oil or fat varnishes—dry easily—at common temperatures, and form a solid and nearly colourless glazing suited for coach panneling and house painting.

The fine copal varnishes do not dry so readily as if mixed in the proportion of three parts of anime and one of copal. Oil varnishes require to be kept a considerable time to ripen, as it is technically termed, before they are fit for use, the time varying from three to twelve months, according to the purpose for which they are intended, in order that the driers and other feculencies may be deposited and the varnish become bright and transparent.

Varnishes are very extensively employed in the arts and for domestic purposes. When we consider the large number of vehicles in use of various kinds, the superior classes of which, as private coaches, omnibuses and cabs, railway carriages, and the paint-work of ships' cabins, houses and household furniture, pictures, &c., all require varnish, we shall be able to form some slight idea of the consumption. The tenders for one railway company alone, the London and North Western, are for 1,500 gallons at a time. Gold and bronze lackering, and varnishes for stoves, &c., are other uses. The recent permission to use methylated spirit in the manufacture of varnish, free of duty, bringing down the price some 10s. to 12s. a gallon, will give even a further stimulus to the demand for resins, and probably lead to the more general employment of varnishes for woodwork instead of paint.

According to Thunberg, the very best Japan varnish is prepared from the *Rhus vernifera*, which grows in great abundance in many parts of that country, and is likewise cultivated in many places on account of the great advantages derived from it. This varnish, which oozes out of the tree on being wounded, is procured from stems that are three years old, and is received in some proper vessel. At first it is of a lightish color, and of the consistence of cream, but grows thicker and black on being exposed to the air. It is so transparent when laid pure and unmixed upon boxes or furniture, that every vein of the wood may be seen. For the most part a dark ground is spread underneath it, which causes it to reflect like a mirror, and for this purpose recourse is frequently had to the fine sludge, which is got in the trough under a grindstone, or to ground charcoal; occasionally a red substance is mixed with the varnish, and sometimes gold leaf, ground very fine. This varnish hardens very much, but will not endure any blows, cracking and flying almost like glass, though it can stand boiling water without any damage. With these the Japanese varnish the posts of their doors, and most articles of furniture, which are made of wood. It far exceeds the Chinese and Siamese varnish, and the best is collected about the town of Jasino. It is cleared from impurities by wringing it through very fine paper; then about a hundredth part of an oil called *toi*, which is expressed from the fruit of *Bignonia tomentosa*, is added to it, and being put into wooden vessels, either alone or mixed with native cinnabar, or some black substance, it is sold all over Japan. The expressed oil of the seeds serves for candles. The tree is said to be equally poisonous with the *rhus vernix*, or American poison-tree, commonly called swamp sumach.

The varnish tree of the Burmese (*Melanorrhœa usitatissima*) is spread over a wide range of country, extending from Memipur, in lat. 25 N. long. 94 E., to Tavoy, lat. 14 N., long. 97 E. It attains its greatest size in the valley of Kubba, distant about 200 miles from the sea-shore. The trees average from 30 to 40 feet high, and have a circumference of from five to eleven feet, four feet above the ground. A good tree yields about 10 or 12 lbs. of varnish annually, and its value at Prome, on the Irawaddy, is about 10d. the pound; it is used in enormous quantities by the natives as a lacquer.

Dr. Wallich states that the natives never experience those deleterious effects from handling the varnish in its liquid state which Europeans generally suffer; in its fresh state, it has very little pungency of taste, and is altogether devoid of smell. The natives are very apt to adulterate that brought to market with sesamum oil.

Wood Oils.—This class of resinous oils, known in all the Indian bazaars as gurgun oil, is obtained by tapping certain trees of the order Dipterocarpeœ (*D. laevis*, Hamilton; and *D. turbinatus*, of Roxburgh), and applying heat to the incision. The tree is a native of Chittagong, Pegu, Assam, the valley of Kubba, and the jungles of the Malayan peninsula, and grows to a great height. It is described as having a straight stem, of more than forty feet to the first branch. When not tapped too soon, the base of the trunk is often of immense girth, having a circumference of thirteen feet and upwards. About the end of the dry season, that is in March and April, several deep incisions are made with an axe into the heart of the wood, and a good sized piece scooped out; into these holes fire is placed, and kept burning until the oil begins to run, when it is received into a bamboo, and allowed to ooze slowly drop by drop. The average produce is about 40 gallons in each season. The oil which flows from the wound is a mixture of a balsam and volatile oil, and when applied as a varnish to wood or other substance, the oil evaporating deposits a hard and durable coat of resin.

These wood oils are chiefly used as natural varnishes, either alone, or in combination with coloured pigments also as a substitute for tar in paying the seams of shipping, and for preserving timber from the attacks of white ants. They are said also to be useful as an ingredient in lithographic inks. This oil has all the medical properties of some of the more esteemed balsams.

From the comparatively imperfect knowledge we possess of the trees from which these valuable substances are derived, the oils generally receive the names of the localities from which they are imported—hence there are wood oils from Canara and the Madras Presidency, Malacca, Pegu, Moulmein and Rangoon, Singapore, Tinnevelly and China. The last-named deserves notice, as being one of the substances of which the well-known and much-prized Chinese lacquer is made. It is used in Singapore for painting the beams and woodwork of native houses, and may also be mixed with paint when not exposed to the sun.

Dammer is the eastern name for a kind of induated pitch or turpentine, exuding spontaneously from various trees indigenous to most of the Indian islands. The principal species are *Dammara Australis* (Don), the Kauri tree of New Zealand, and *D. Orientalis*, the pitch tree of Amboyna. The trees yield the dammer in amazing quantity, and generally without the necessity of making incisions. It exudes through the bark, and is either found adhering to the trunk or branches in large lumps, or in masses on the ground under the trees. As these often grow near the sea-side, or on the banks of rivers, the dammar is frequently floated away, and collected in distant places as drift. It is exported in large quantities to Bengal and China, and is used for all the purposes to which we apply pitch, but principally in paying the bottoms of ships. About 200,000 bundles of dammar are annually exported from Siam. Dammar fetches from 26s. to 32s. per cwt. in the London market. 100 to 300 cwt. of dammar and resin are annually exported from Ceylon.

The fruit of *Diospyros Embryopteris*, a native of the East, is so glutinous as to be used in Bengal for paying boats. A cheap and ready substitute for tar for preserving cordage, &c., might easily be found in some of the numerous resins and gum elastics of India.

Copal is a valuable and singular kind of resin, that, according to some authorities, naturally exudes from different large trees found in the East Indies. Dr. Ruschenburger (Voyage Round the World) still asserts that it is a gum found about the roots, whence it is dug up in large quantities, and is often obtained from places where the tree had been grown many years before. The best copal is of a bright yellow colour, as transparent as amber, in small rounded lumps or flat pieces, hard and brittle, but easily reduced to powder. Its specific gravity is about 1·100. When dissolved in linseed oil, it forms a beautiful varnish, which, when applied to pictures, snuff-boxes, tea-trays, &c., gives lustre to the painting and brings out the colours. Copal is liable to be confounded with gum anime, which exudes from the roots of the locust tree (*Hymenæa Courbaril*.)

According to M. Landerer, of Athens, there are three varieties of copal, differing from each other in their properties, viz., Brazilian, West Indian, and East Indian, or Levantine, copal. The latter variety is sold in the bazaars of Jerusalem, Mecca, and other places as a species of choice incense, and it plays a very leading part in all the fumigating drugs of the East. The people employed in the collection of the copal in Palestine and Abyssinnia dig deep trenches round the trees, and then collect and sort the pieces of gum which fall into them. They are afterwards freed as much as possible of the earth that adheres to them by washing and stirring. African copal is obtained from a species of *Hymenæa*, and from fourteen to seventeen tons are imported to Liverpool from Sierra Leone. New Zealand copal is the Kauri gum; Brazilian copal is the produce of *Trachylobium Martianum*. The imports of gum copal, which, in 1848, were 759 tons, dropped, in 1849, to 200 tons. From the Phillippines we imported 354 cwt. of copal in 1851; 338 cwt. in 1852; and 497 cwt. in 1853; and from Singapore the exports have lately been increasing. In 1849 we received from that entrepot 53 cwt.; in 1850, 40 cwt.; in 1852, 218 cwt.; and in 1853, 521 cwt. The trade reports also record the import of 832 cwt. of copal from New Zealand in 1852, and from those islands 3217 cwt. of gum, not enumerated, were received here in 1853. In commerce, copal is distinguished into the hard and the soft kinds. The chief varieties of the former are—First, copal from Madagascar (in large flat yellow pieces), which, when cold, is tasteless and odourless, but, when heated, diffuses an aromatic odour: this kind is rather rare. Secondly, the East India copal, the most common commercial variety; it is rough on the surface, bearing the impression of sand. The best specimens are colourless, and in small pieces, constituting the copal from Calcutta. A third, but very small variety, is brought from the Brazils and south of Africa. We receive all the copal proper of commerce from India, whatever its primary source may be. In the Calcutta variety pieces of all the others are to be found; nor is a distinction readily to be made between the white copal of Calcutta and the yellow resin of Bombay; the difference appears to depend only on the care bestowed on the selection and purification of the pieces. The various resins, from anime to soft copal, Indian and Madagascar, seem to form a continued series, differing only in the increased quantity of oxygen they contain. A curious variety of copal is that in the pebble form, rounded by the action of water, of which there are specimens on the table.

Copal is the Mexican generic name for all resins. In the collection of products from Mexico shown at Paris there were several resinous gums, of which no particulars, however, were obtainable—one, an unnamed resin, very much like anime, another termed Axin resin, which burns with little flame and blackens, having evidently much gum with it—a whiter kind, called Archipan resin, has much the same properties, and a bitter flavour. A nominal copal from the same quarter resembles very closely the resin of Tacamahaca, being of a white colour, with a coniferous smell.

Gum Anime of commerce is a resin of great value to the varnish maker, but it is now largely replaced by copal. Much of the anime received is believed to be the produce of the locust tree, *Hymenæa Courbaril*, and is, therefore, Western Anime, the Courbaril resin of Demerara. It is obtained there by digging in the vicinity of the roots of the tree, from which it exudes in a vertical direction in columns or pieces upwards of a foot in length. It may also be obtained by tapping the tree, when in the course of a few days a large solid mass is formed. It may be obtained in great abundance in various parts of British Guiana.

The best anime is, however, obtained from Zanzibar, and some other parts of Africa, whence it is imported in mats, and the fine and medium in cases. The imports are not large of gum anime. In some years it has reached thirty tons, in others it has not exceeded five or six. We now receive about 280 tons.

Mastic is derived from the *Pistacia lentiscus*, a very common shrub in various parts of Northern Africa, where it is sought out for its resinous produce.

In the island of Chios, where the tree is cultivated for the sake of the resin as carefully as the vine, it is customary to make small incisions in the trunk and chief branches, about the end of July. From these clefts the sap, which gradually thickens, exudes; it hangs in larger or smaller drops, and when it is very abundant, trickles on the ground, and dries there. It is detached from the tree by means of a very sharp instrument; often it is caught upon cloths spread under the trees, in order to prevent any soil being derived by contact with the ground.

The largest consumption of mastic is in the East, where it is universally chewed, and thence derives its name. It is asserted to be effectual in whitening the teeth, strengthening the gums, and sweetening the breath. Mastic is also used in the preparation of the finer varnishes for pictures, &c. Owing to a recent more extensive demand for France and deficient supplies, this gum has run up in price considerably, being now vended at about 1s. 6d. the ounce. As much as 1,500 cwt. was formerly annually exported from Chios. Dissolved in alcohol mastic forms a very useful cement. It is obtained in Brazil, from the *Pistacia Atlantica*, and in Beloochistan and Affghanistan from other varieties, *P. Kinjuh* and *P. Cabulica.*

Most of the Eucalyptus genus in Australia furnish gum in abundance, particularly the red, spotted, and white gum, the iron and stringy bark, and other trees. It exudes both spontaneously and in larger quantities, when incisions have been made in the trunk, more particularly after rain. It is seen in masses upon the trunk, but its particles have so little tenacity, that when in a concrete form any attempt to detach them in one entire lump fails, and it crumbles immediately into innumerable fragments.

This gum resin has a strong astringent quality, and is one of the varieties of the kino of commerce.

At first it is of the consistence of very thick syrup, and immediately after rain, may be seen flowing from an incision or cleft in the tree very abundantly, being then of a beautiful bright red colour, becoming of a dark shining red, and hardening by exposure to the air.

The *Angophora lanceolata*, or apple-tree of the colonists (a genus allied to that of Eucalyptus) also yields a dark and astringent gum from its trunk and branches. A gum as fine as amber exudes from the stem of a Macra Zamia in Australia.

The KOWRIE GUM of commerce is the produce of *Dammaris Australis*. For a long time it was much neglected, and the shipments made to this market did not repay the cost of its collection in the colony. The Americans however, purchased it readily at first for £16 to £20 the ton, and it was used by them as a substitute for copal in the manufacture of varnish. From 14 to 17 tons come in annually to Liverpool, and within the last year or two it has been in greater favour in the London market, and larger supplies are coming forward. In 1851, 16½ tons were shipped from the port of Auckland, and in 1852, 107½ tons. This resin may be obtained in any quantity in the northern districts of New Zealand, ranging from twenty miles south of Auckland to the North Cape.

The Kowrie pine grows to a gigantic size. The gum resin exudes from it, and bears some resemblance to the dripping of a wax candle in the wind. It is now in demand for the manufacture of varnish and other purposes, and it is found in masses of several pounds weight. The Kowrie gum, though clearly the produce of this tree, is dug from the ground in quarters where no traces of trees now exist. The gum-diggers probe the soil with long iron spikes, and extract the gum thus indicated from generally a couple of feet below the surface. These pieces of gum are probably the relics of primeval forests, which have disappeared long ago. The resin streams copiously from the stumps of the trees which have been felled, covering them with an appearance like wax, and hardening in the air.

BOTANY BAY GUM is a yellow resinous exudation from the *Xanthorrhæa hastilis*, and other species of the grass tree of Australia, which were generically named by Swartz, from this peculiarity. It is darker than gamboge, and less uniform in appearance, and not entirely soluble in alcohol. It has been used medicinally, to unite the edges of wounds, and in the form of tincture, with opium, in dysentery and diarrhœa, and also forms the base of a cement. This resin contains benzoic and cinnamic acids. Another species of the same family, *X. Australis*, furnishes a more brittle resin, of a brilliant dark-red colour, known in the colony as "black boy gum" These resins are spoken highly of as useful for varnish, and as substitutes for shellac. The grass tree is one great characteristic of the scenery and of the vegetation of Australia. It puts one in mind of a tall black native, with a spear in his hand, ornamented with a tuft of rushes. On the spear is found an excellent clear transparent gum, and from the lower part of the tree oozes a black gum, which makes a powerful cement, used by the natives for fastening stone heads on their hammers. This gum resin may be obtained in inexhaustible quantities.

Capt. Wray, R.E., submitted a report to the local authorities of Western Australia, last year, on the manufacture of illuminating gas from the Xanthorrhæa, at one-third the expense of lighting with oil or candles.

The plant grows in abundance all over the colony, and is composed of a core of hard fibry pith, about half of its whole diameter, round which there is a layer of resin, varying from half to one inch or more in thickness, which forms the connexion between the leaves and the core. Between these leaves, and also adhering to and covering them, is a considerable quantity of resin; resin also exudes in large lumps from the sides of the plant.

Method of obtaining the material.—In the first instance, the leaves and resin were separated from the core by breaking up the plant with an axe, and sifting the resin from the leaves, but it was found by experience that as much gas was obtained from an equal weight of the leaves and resin together, as from the resin alone. The quantity of resin obtained from an average sized "black boy" was about 45lbs. weight. This was collected easily at the rate of 5lbs. per hour by a person, having for his tools an axe and a sieve.

Should the resin be collected for export, I am satisfied that by a proper arrangement of crushers and sieves, a labourer, at 4s. per diem (the colonial rate), could collect at least one hundred weight per diem, enabling the resin to be brought to market, at Freemantle, for £4 per ton, the ton weight measuring forty five cubic feet when pressed. The quantity of pure gas obtained by Capt. Wray's experiments was at least four cubic feet to the pound of resin and leaves, but much more might be obtained by a more complete apparatus.

A cart load of the plants, 8 in number, weighed 1048 pounds. When the core was removed the leaves and resin weighed 628 pounds. This core is very good fuel when mixed with other wood. The specific gravity of the gas is 888. The products of the distillation are gas, tar, and coke. The tar obtained was about 1 quart for every 10 lbs., and this, when re-distilled, gave 8 per cent. fluid ozs. of naptha, and 20 per cent. of a sweet spirituous non-inflammable liquor. The coke remaining was about ¼ of the original weight, and with other fuel burns well. The coke of the leaf has a bright shining appearance, and when ground with oil is a very good substitute for lamp black in paint. The gas has a smell somewhat similar to coal gas, not nearly so offensive, but sufficiently strong to make any escape immediately perceptible. Its illuminating power appears to be very superior to coal gas, and its light very white.

Captain Wray is of opinion that when the production of the gas from the resin of the Xanthorrhea is conducted with suitable apparatus, the cost per annum will be materially reduced, so far indeed that the resin may become a large and profitable export from the colony to places which are either not lit at all, or lit with oil. Among these may be enumerated Singapore, Hong Kong, Melbourne and Adelaide.

The supply is, I may say, unlimited, and even were it not so, it would be advantageous to get rid of the plant from all the land fit for cultivation. Should, however, it be found that the plant was likely to get scarce, the resin might be obtained by tapping.

The gum resin of the New Zealand flax (*Phormium tenax*) is admirably adapted for sealing letters, and when remittances are enclosed, is frequently made use of by the colonists for that purpose. It is insoluble either in water or spirit, and so thoroughly penetrates the envelope as to become part and parcel of it, nor is it possible to get at the contents of a letter so sealed.

One of the gum trees of Popayan in Colombia yields a resin so remarkably tenacious, that when used to varnish ornamental work, it resists the application of boiling water, or even acids, for which reason tables, cabinets, &c., made by the Indians, and lacquered with it, are highly valued at Quito.

At Copiapo a resinous gum is obtained from the branches and berries of a shrub, with a leaf like the rosemary. It is made into cakes of two feet long by one foot thick, and is used for paying of ships, glazing the earthen jars of the country, &c.—(*Frezier's Voyage.*)

Thenethea, the produce of an undescribed plant, is used by the Burmese as a coating for umbrellas and as a varnish.

The resins of Algiers are those from the teberinthe cedar, juniper, *pinus halepensis*, of which there are large forests, *thuya articulata*, and lentiscus, alk or lek, sandaric, mastic, and pitch and tar.

In 1853, France imported over 3 million kilogrammes of resinous substances, valued at 1,844,337 francs.

Sandarac is obtained from the *Callitris quadrivalvis*, Rich., the *Thuya articulata*, Wahl. This tree furnished the highly-prized citrus wood of the ancient Romans; and the Thuya wood of Algeria has recently again come into high repute among the French cabinet-makers. Experiments for cultivating it on a large scale are now being carried out in the French African provinces.

It should be remarked that under the generic name of Thuya, various coniferous trees furnishing resin are confounded in Algeria. Sandarac is used in the preparation of varnish, and also for making pounce.

At the Paris Exhibition a light and transparent hard resin, from Coorg, was shown, of which I have a specimen on the table. It is said to be soluble in spirit, and suited for coach varnish, but Mr. Wallis does not speak well of it. The piney varnish of the *Vateria Indica*, is a kind of dammer, which is too soft for general purposes. An Assam resin, unnamed, is also a species of dammer, on which spirits of wine has little or no action.

The Gaub tree resin from Beerpoor is a very dark amber colour, which melts lighter in colour by heat and mixes with oil. There is also a more transparent lighter variety shown from Calcutta.

According to my correspondent, Mr. Ondaatje, a black resin is produced by a tree growing in the more barren parts of the district of Ceylon, in which he resides (Badulla), and belonging to the Anacardiaceæ, a tribe of plants which abounds in black resinous juice, whence the black varnishes used in China and India are obtained. It would seem to be the *Semecarpus obovatum*. From natural fissures of the bark, there runs out a clammy juice, which at first white, becomes afterwards black by exposure to the sun's rays, hardening into masses of different sizes with pieces adhering. The resin is hard, breaks with a smooth shining fracture, burns with a bright flame, melts in fire, and is soluble in turpentine, insoluble in water, and adheres strongly to wood and metal. It is free from acridity. It forms a superior black varnish when added to a saturated solution of vateria resin, or East Indian copal, in oil of turpentine.

Two specimens of Ceylon resin, which I have here from the Paris collection are merely species of dammer.

East Indian Gum Kino.—This, one of the most useful indigenous gum resins of the East, is the produce of the *Pterocarpus marsupium*, Roxburgh. The gum flows out on longitudinal incisions being made in the bark, which, being fleshy and very thick, is easily done. It trickles down in a tenacious semi-fluid form, and is collected in a cocoa nut shell. On exposure to the sun in flat plates, it soon hardens into angular brittle shining fragments, of a bright ruby colour, highly astringent, and readily soluble in hot water. The gum changes into a blood red colour by alkalies, which, however, destroy its astringent properties. It is precipitated by the salts of iron, silver, lead, &c., and, with sulphate of iron, forms a fine ink. It dissolves readily in water, to which it imparts its own beautiful colour.

Another variety of Indian kino exudes during hot weather from natural fissures and wounds in the bark of the *Butea frondosa*, a very common leguminous tree. It is known in commerce by the name of Bengal kino, or Gum butea, being closely allied to the kino of Pterocarpus, in its chemical and medicinal properties. The natives of India use it for tanning, but as it imparts to the leather a red colour, it is considered objectionable by European tanners. Kino is commonly used in medicine for its astringent properties, especially in diarrhœa, chronic dysentery, and other such cases.

Amber.—The source of amber was long uncertain; by some it was considered a carbonaceous mineral, but it is now universally supposed to be a vegetable resin, the product probably of a Pinus. It is too well known in appearance to need description. It has several commercial uses. Being commonly translucent, and susceptible of a good polish, it is made into ornaments as necklaces. It is the base of an excellent varnish, and the source of succinic acid, which is employed in chemical investigations. The beautiful black varnish used by coach-makers, is a very carefully prepared compound of amber, asphaltum, linseed oil, and oil of turpentine. Amber often contains insects, flies, ants, spiders, &c., some of which are so delicately formed that they could not have occurred except in a fluid mass, such as a volatile oil or natural balsam. Mr. Wallis, of Long acre, has one of the largest and most interesting collections of these fossil insects I remember to have seen, and they occur not only in amber, but occasionally in the courbaril resin of South America, in copal and anime, and in copal from Accra. In its appearance and physical properties, amber strongly resembles copal, which is often fraudulently sold for it in the Indian bazaars.

We derive our chief supplies from Prussia, where it is thrown up on the coast between Konigsberg and Memel. The imports in the last few years have averaged about 40 cwt. yearly. Large deposits of amber were found a few years ago in some lakes on the eastern coast of Courland, not far from the Gulf of Riga; and in January, 1854, a bed of yellow amber, apparently of great extent, was found on sinking a well at Prague, from which pieces weighing two and three pounds were extracted. The largest block known is in the Royal Cabinet at Berlin, and weighs thirteen pounds.

This fossil is also found in Madagascar, in Japan, on the shores of the Indian Archipelago, and in small quantities on the coast of China. It forms a considerable item of import in the Chinese ports, the greater portion coming from the eastern coast of Africa; its value there formerly was very great as an incense and for ornaments. Transparent yellow pieces are considered the best, and the price in the East, as here, varies according to size and quality; for its colour ranges from black and yellow through red and white. A resin called false amber—no doubt a copal—is among the exports from Calcutta to Great Britain to the extent of several tons.

Lac.—This important resinous substance, which comes into our ports from the East Indies in various forms, to the extent now of 2,500 tons per annum, is obtained from the incrustations made by an insect (*coccus lacca*), similar to the cochineal insect on the branches and twigs of many trees in India, as *Vatica laccifera*, *Butea frondosa*, *Inga dulcis*, *Feronia elephantum*, *Erythrina indica*, *Schleichera trijuga*, &c. The lac is formed by the insect into cells, somewhat resembling a honeycomb, in which the insect is generally found entire, and owing to whose presence stick lac yields by proper treatment a red dye, nearly, if not quite, as bright as that obtained from cochineal, and more permanent.

Lac is found encircling the branches of these trees in the form of a tube (half an inch to one inch in diameter); the broken branches, with incrustations at various distances, is called in commerce stick lac, which ought to be semi-transparent. The colouring matter, exhibited by grinding stick lac, and then treating it with water, constitutes seed lac. I have on the table specimens in the various forms, of the crude stick lac attached to branches of various trees, seed lac, lump lac, shellac, thin plates of a yellowish and brown colour, known as button lac, thread lac, and bleached or white lac of the shops.

The range of production of this resin is very extended, reaching from Bombay to the Eastern Archipelago, Ganjam, Nepaul, Burmah, the jungles of the Malay Peninsula, and those of Southern India. In the latter district it is not much collected for commercial purposes, although always procurable in the bazaars. The best lac is produced there upon the *Schleichera trijuga*, or cosumb tree, which abounds in the Central Provinces, and yields the colouring matter twice a-year. Bur lac is produced in the Rajpootana states, on the *Ficus indica* and *religiosa*, *Zizyphus jujuba*, and *Acacia concinna*.

The resin in stick lac constitutes about 68 per cent; in seed lac, 88 per cent; and in shellac, 91 per cent. The wax, which forms about 5 or 6 per cent., is analogous to myrtle wax

Our imports from India in the last twenty years have been :—

Years.	Shellac.	Seed-lac.	Stick-lac.	Lac-dye.
	Cwt.	Cwt.	Cwt.	Cwt.
1833	7,784		1,439	2,919
1841	29,066		2,340	10,905
1843	27,790		733	10,700
1844	14,873		1,194	7,636
1845	22,471		187	12,846
1846	9,449	418	293	5,541
1847	8,637	1,953	622	7,418
1848	14,362	34	358	4,449
1849	14,786	60	2,695	13,546
1850	20,245	1,524	9,189	17,930
1851	19,745	3,821	5,317	17,922
1852	16,356	934	3,054	17,139
1853	28,512	402		17,674

Exports from Calcutta. Twelve months, ending 31st August, respectively :—

	1855.	1854.	1853.
SHELL-LAC :—	Ind. Maunds.	Ind. Maunds.	Ind. Maunds.
To Great Britain.........	26,147	20,659	42,321
To France..................	8,609	5,951	11,324
To North America......	124,630	21,103	11,290
	158,786	47,713	64,945
LAC-DYE :—			
To Great Britain.........	13,177	23,323	25,776
To France..................	1,152	510	3,141
To North America......	5,884	799	7,745
	20,213	24,632	36,662

A resinous gum, called Alk or Lek (whence the word lac), flows from the *Pistacia Terebinthus*, Linn., in Algeria, which, mixed with other ingredients, is given as a purgative for fowls. It is supposed that this tree would yield good terebinthine. The gum flows so abundantly, even without incision, that it is often dangerous to sleep under the trees.

Under the commercial name of DRAGON'S BLOOD, the produce of several species of Dracæna, is imported, to the extent of about 100 packages of 1 to 2 cwt. each. In commerce the resin occurs in powder, grains, masses, drops of the size of an olive, and in sticks enveloped in the leaf of the talipot palm. Its chief use is for colouring artificial tortoise-shell, and in paints, varnishes, sealing-wax, &c. It stains marble, especially if the stone be heated. The resin is used occasionally in medicine as a tonic and astringent, and also in opiates and dentrifices. Occasionally a brick red powder, known in the east as wurrus, has been passed off here for dragon's blood. This is collected from the seed-vessels of a euphorbiaceous tree, the *Rottlera tinctoria* of Roxburgh, occurring in Arabia, Eastern Africa, and various parts of India. The Chinese esteem dragon's blood highly. It is obtained in Socotra from the *Dracæna draco*, which is usually met with on the hills at the elevation of 800 to 2000 feet above the level of the sea. There are two kinds there, and the best is of a dark crimson colour. Jacquin states that the lump dragon's blood is the produce of *Pterocarpus draco*, but this is very questionable. A common kind in the eastern bazaars is the produce of the red astringent fleshy fruit of the *Calamus draco*, or by incision in the stem, or natural exudations from various parts of the plant. An inferior kind is obtained by boiling the fruits. In the Madras bazaars dragon's blood ranges in price from £3 to £11 the maund of 82lbs. according to quality.

Dragon's blood was the cinnabar of the ancient Greeks. In the time of Dioscorides the opinion prevailed that it was the indurated blood of a dragon; and other old authors tell us that the tree received its name from having the figure of a dragon upon the fruit.

A red juice flows from the wild nutmeg on incisions being made into the bark. This hardens into laminated resinous pieces, red and transparent, and forms a variety of the substance known in commerce under the name of dragon's blood. Professor Lindley states, on the authority of Erdlicher, that a species of Myristica, of the Philippines, yields a crimson juice, which is collected from incisions in the trunk, and used as a substitute for dragon's blood, under the name of Durgan.

GUM GUIACUM of commerce. This solid and very friable resin, of which a few tons come in yearly, is the produce of the Lignum vitæ tree of the West Indies (*Guiacum officinale*). The colour of the resin is yellowish brown, but it becomes green on exposure to light. It is chiefly used medicinally in gout, chronic rheumatism, &c.

The wood being very hard and heavy, is extensively used for making pestles, rulers, and skittle-balls, and various other articles of turnery-ware. The resin exudes naturally from the stem of the tree, and may be seen in all seasons of the year. It is obtained most copiously by wounding the tree, which is usually done in May. Another method is by heat. The trunk and larger limbs being sawn into billets of about three feet long, an angular hole is bored lengthwise in each, and one end of the billet so placed on a fire that a calabash may receive the melted resin, which runs through the hole as the wood burns. It is also obtained in small quantities by boiling chips, or shavings of wood, in water, with common salt. The resin swims at the top, and may be skimmed off.

In the early part of the century we used to receive this resin from Portobello, whence 22 tons were shipped in 1801; now we get it chiefly from St. Domingo and Jamaica. We received from Hayti 54 cwt. in 1849, 447 cwt. in 1850, 78 cwt. in 1851, and 5 cwt. in 1852. It is not in large demand.

The Icica tribe, lofty trees of South America, produce resinous exudations of value in the districts where the trees occur. Of these I have specimens here in the Carana and Tacamahaca resins; and the resin of Perama, another dark resin from Central America. The *Icica Icicariba*, or *Amyris elemifera*, produces elemi, which resembles olibanum closely in its properties and uses.

In Demerara, Jamaica, and other quarters, a gum resin, similar to the gum anime of commerce, exudes from the lowest roots of the simiri or locust tree (*Hymenæa Courbaril*) in a vertical direction, in columns or pieces upwards of a foot in length. It may also be obtained by tapping the tree, when in the course of a few days a large solid mass is formed. It forms an excellent varnish, superior to Chinese lac, and is used for the same purposes as copal. It may be obtained in various parts of British Guiana in great abundance. Some was shown at the French Exhibition, of which I have a sample here. It is of a bright colour, with a brittle fracture, and is not unlike anime. A courbaril resin from French Guiana was also shown, which was of a bright lemon colour, but much coated. A scraped copal from the same quarter, appears to be a good useful resin.

It is very satisfactory to find our colonies and foreign possessions drawing forth their latent energies in so highly creditable a manner. The admirable collection of raw products shown at Paris by the Island of Jamaica, and fitly rewarded with a gold medal, is an evidence of the talent, exertions, and activity displayed by the members of the kindred Society of Arts in that Island. Demerara, Madras, and New South Wales have also made excellent displays, and achieved much for the interests of commerce, science, and the arts.

Fragrant Incenses.—A common use, and one of great antiquity, for many of the fragrant resins, is for odoriferous incenses in temples, &c.

In the East we have the gum Benjamin (the most costly), olibanum (the ancient frankincense), myrrhs, true and false as the googul, the muthipaul, the doopada resin, and poona rumpoly from a species of Boswellia. What is chiefly sold as common frankincense in our shops is gum Thus. In Trinidad, incense is obtained from the *Trichilia trinitensis*, but the list of fragrant and balsamic resins might be widely extended, and it will suffice to notice a few of the most important commercial resins of this class.

Gum Benjamin—or Benzoin, of commerce—is said to be the produce of the *Styrax Benzoin*, a lofty tree, which grows in Siam, Sumatra, and Java; but, according to some accounts, it would seem to be also obtained from a smaller tree, cultivated in Borneo. The best balsam is obtained in Siam by incisions made in the trunk of the tree, after it has attained the age of five or six years. The resin is white, and transparent at first. About three pounds are given by each tree for about six years. It forms an article of export from Siam. From Singapore, the exports in 1852 were to the extent of 1,282 piculs, and 168 piculs in 1853. Java imported last year Benjamin of the value of 176,182 florins. The different varieties bear a price proportioned to their goodness; the finest quality used to range from £10 to £30 per picul of 133lbs. Benzoin is the frankincense of the far east, and has long been used for incenses in the Roman Catholic, the Hindu, Mahomedan, and Budhistic temples, and probably in the Israelitish worship. Wealthy Chinese fumigate their houses with its grateful odour. Olibanum, which is cheaper, is in similar and more general use in other parts of the East Indies.

The **Gum Olibanum** of commerce is the frankincense of the ancients and the luban of the Arabs. In India it is obtained from several species of Boswellia, *serrata*, *thurifera*, and *glabra*. No botanical description appears to have been published of the African tree, although Capt. Kempthorne, Major Harris, and other travellers, furnish some general account of it. The tree invariably grows from the bare and smooth sides of the white marble rocks, or from isolated blocks of the same, scattered over the plain without any soil whatever. On making a deep incision into the trunk, the resin exudes profusely, of the colour and consistence of milk, but hardening into a mass by exposure to the air. The young trees produce the best and most valuable gum, the older merely yielding a clear glutinous fluid resembling copal, and exhaling a strong resinous odour.

Olibanum was formerly in high repute as a sovereign remedy against inflammation of the eyes, and as an efficacious remedy in consumption. It was also commonly drank as a stimulant in wine. But for all these purposes it has long gone out of use, and is chiefly imported here for reshipment to the Continent, being bought up by the Greek merchants.

The trees that produce the luban or frankincense are of two kinds, viz., the luban meyeti and the luban bedowi. Of these the meyeti, which grows out of the naked rock, is the more valuable, and when clean picked and of good quality, it is sold by the merchants on the coast for 1¼ dol. per frasila of 20 lbs. The luban bedowi of the best quality is sold for one dollar per frasila. Of both kinds the palest colour is preferred. The trees vary greatly in height, but are never above 20 feet, with a stem of nine inches in diameter. Their form is very graceful, and when springing from a mass of marble on the brink of a precipice, their appearance is especially picturesque.

Although the Wursungili range and other mountainous tracts afford an inexhaustible supply of frankincense, it is a mistake to suppose that elevated districts produce the best gum.

Lieut. Cruttenden, in his journey among the Edoor tribes, states that the gum of the large leaf kind of frankincense tree is not much prized. He noticed in his travels many other kinds of gum trees, for which he could find no name, and one of these he considered to be the gum elemi.

The quantity of gum of all kinds annually exported on an average from the Somali country, on the north-east point of Africa to India and the Red Sea, may be stated at 1,500 tons.

The wild gum trees in many districts are considered family property, like the date palms in other parts of Africa. Sometimes the young gum trees are transplanted, and thus cultivated they thrive well, and produce largely.

Major Harris describes the Myrrh tree (*Balsamodendron myrrha*) as growing abundantly on the Abyssinian coast of the Red Sea to the Straits of Bab-el-Mandab, over all the barren hill-sides of the low zone inhabited by the Danakil or Adaril tribes. It is called Kurbeta, and there exist two varieties; one (producing the better description of the gum) being a dwarf shrub with deeply serrated crisp leaves of a dull green, while the other, which yields a substance more like balm than myrrh, attains a height of ten feet, and has bright shining slightly dentated leaves. The myrrh, called Hofali, flows freely from any wound, in the form of a milky juice, possessing a perceptible acridity, which either evaporates or becomes chemically changed during the formation of the gum. The seasons for collecting it are in January, when the buds appear after the first rain, and in March when the seeds are ripe.

Every passer-by transfers such portions of it as he may find to the hollow boss of his shield, and exchanges it for a handful of tobacco with the next slave-dealer whom he meets on the caravan-route. The merchants also of the sea-coast, before returning from Abyssinia send into the forests that gird the western bank of the river Hawash, and bring away considerable quantities of the *Hofali*, which is sold at a high price.

The natives administer it to their horses in cases of fatigue and exhaustion. (*Trans. Linn. Soc.*)

Cedar Gum (*Widdringtonia junipercides*, Endl.)—From the various branches and cones of the cedar tree of the Cape Colony exudes a gum which soon hardens in the air, becomes solid, yellowish, and transparent, and scarcely differs from the gum olibanum of commerce. This cedar gum is locally used for various medicinal purposes, for compounding plasters and preparing varnish.

Bdellium, or false myrrh, is believed to be the produce of *Commiphora Madagascarensis* of Lindley—the *Amyris commiphora* of Roxburgh. Googul is the common name for it in India. The gum resin is semi-pellucid and more yellow than myrrh, and a fragrant balsamic resin is also obtained from the tree.

The Doopada resin, or East Indian copal, exuding from the *Vateria Indica* in Mysore, Canara, and Malabar, &c., is used as a fragrant incense in the temples; the quantity procurable is very considerable. Muthipal, the resinous exudation of *Ailantus Malabaricus*, Decandolle, is said to be used as an incense in Cochin and Travancore. A very fragrant gum, the Hyawa, or incense, suitable for pastiles and similar purposes, is also obtained from the *Icica heptaphylla* of Aubl.

The shrub which produces the balsam of Mecca (*Balsamodendron opobalsamum*) is found, according to Major Harris, on the Arabian coast, at Cape Aden, where it is called Beshan, either the original of, or a derivative from, the word balsam. It is the *Balessan* of Bruce, who did not meet with the true myrrh tree. The balsam flows copiously from incision, and the ethereal oil speedily evaporating, a tasteless gum remains.

Balsams.—When in their semi-fluid state, owing to the volatile oil they contain, resins are termed balsams, and the most important commercial balsams are Turpentine, (already noticed) Copaiba, Tolu, Peru, and Canada Balsams, Styrax, or Opobalsamum, and China varnish. The oleo resins are chiefly used as sources of the volatile oils and Gum resins in medicine. An aromatic oil, called oil of gum kikekunemale, is, according to some authors, obtained from a species of copal in the East.

Camphorwood-oil, obtained from *Dryobalanops camphora*, is used largely in Singapore as a substitute for turpentine, and sells at from 7d. to 10d. a bottle. I have several specimens here of the oils extracted from different resins with which Mr. Wallis has obliged me. A bituminous oil, obtained in the volcanic regions of the islands of the Eastern Archipelago, is shipped to Holland, and when distilled furnishes petroleum.

The balsam of capivi is obtained chiefly from *Copaifera guianensis* and *officianalis*, natives of South America and the West Indies. The imports from Brazil in the last five years have averaged 570 cwt.

Storax, copal and other gums, may be obtained in large quantities from the Indians in the interior regions of South America, and at prices merely nominal. The Balsam of Peru is imported to the extent of five or six tons per annum, being obtained from *Myroxylon peruiferum*. It is, however, obtained in Central America, and not in South America. Twenty-six cases of East India balsam were imported in September from Moulmein. The balsam exudes so abundantly at the proper season from incisions in the stem of the tree that 12 lbs. are frequently obtained in the space of three or four hours. The balsam of tolu is another oleo-resin imported to the extent of a few tons from South America. It is used in medicine, and as a flavouring ingredient by confectioners and perfumers. It is the produce of *Myrospermum toluiferum*. Liquid amber, or styrax, is another balsam of commerce of small consumption. Styrax Benzoin, or storax, in tears from Amboyna, from *Styrax officinale*, is a powerful and fragrant balsam, recently imported from the East. It formerly fetched a very high price.

Canada Balsam.—This well known fir balsam is procured from the American silver fir (*Abies balsamifera*). It is naturally deposited in vesicles on the trunk and limbs, and is collected by bursting these tumours and receiving their contents in a shell or cup. The fresh turpentine thus obtained is a greenish, transparent fluid, of an acrid, penetrating taste; it is highly celebrated here for medicinal and other purposes, and is generally designated in England "Canada Balsam." It makes a very fine transparent varnish for water-colour paintings, which does not become darker with time, and is much used in wax flower making.

Muscat is a great entrepôt for the collection of gums for re-distribution. About 15,000 to 16,000 maunds of assafœtida are imported there annually from Persia in Arab vessels, the greater part of which is re-exported to India.

Four thousand maunds of aloes from Socotra, and some of an inferior quality from Mocha and Macula are also received for reshipment to India, and 3,000 to 4,000 maunds of gum ammoniacum from Persia intended for Bombay. The maund is about 28 lbs.

Gum copal is imported from Zanzibar, and some, quantities of frankincense, gum galbanum, and gum from Persia and Bassora.

Asphalte is manufactured at home by one or two companies to the extent of two or three thousand tons per annum. Small imports are received from America and the Continent for the use of varnish-makers, but as it does not appear in the trade returns, it is probably included with pitch, of which we receive about 300 or 350 tons yearly. But little of the genuine Egyptian asphalte is now to be met with. There is one prolific source of asphaltum from which little commercial benefit has yet been derived, at least to the extent to which it is susceptible, and that is the Pitch Lake of Trinidad, covering a surface of about a mile in length by an eighth in width. Though the surface is generally too fine to receive a foot-print—just hard enough to cut readily with an axe—there are places where the pitch oozes out in nearly a liquid form. But the pitch is not confined to this locality. There are masses of it extending wider inland, and in several points it reaches to the sea-beach, whence it is shipped in large quantities to America, and some of the West India islands, to use in building and flagging streets. Near the Lake some of the negroes occupy themselves in boiling down the pitch, some of which is shipped in a pure state, and some, with the addition of lime, exported as mastic. Many hundreds of tons have been thus taken from the lake, to the depth of about a foot below the surface. The hole is always filled again within two days after the cutting, by the upheaving of the mass. It appears as though billions of tons of pitch had boiled up from the bowels of the earth, from the effects of an immense subterraneous fire, which had been extinguished, and left the asphaltum to cool in enormous bubbles.

Various attempts have been made to apply the inexhaustible store of bitumen afforded by this lake to some useful purpose. It is the best substitute for macadamization yet discovered. Mixed with sand and pebbles it is much used for pavements and the ground floors of houses at the town of Port-au-Spain, a purpose for which it is admirably adapted. The late Sir Ralph Woodford, when governor of the island, tried to obtain carburetted hydrogen gas from it to light a beacon on the tower of Trinity Church. It burnt well, but created such an intolerable stench, that the experiment was obliged to be abandoned. The person entrusted with the trial, however, knew nothing of chemistry. It has been employed to advantage as fuel by the American steamers plying on the Orinoco. It is thrown in the furnace among the wood, fusing too readily to be used alone.

With ten per cent. of resin oil it forms an excellent pitch for vessels. It was used for this purpose so far back as 1593 by Sir Walter Raleigh, who tells us that this substance was then in general use by the various tribes of Indians in the river Orinoco for caulking their canoes. It has been recently coming into use in the manufacture of petroleum. It might, I should suppose, form a base for some of the compressed artificial fuels.

The Earl of Dundonald has long had great faith in its ultimate commercial utility. Twenty or thirty years ago he shipped two cargoes of it to England, but it was found then to require too much oil in order to render it useful. Lately his lordship has purchased a large tract of the pitch lands, including twenty-six acres of the lake, and has instituted various experiments with the view of substituting the bitumen for India rubber and gutta percha in the manufacture of waterproof fabrics, covering of telegraph wires, &c. Judging from the specimens of these shown by his agent at Port-of-Spain (Mr. C. F. Stolmeyer), these efforts bid fair to be quite successful. It seems only necessary that the same amount of intelligent enterprise should be directed to the subject in order to render this wonderful reservoir of bitumen a source of great individual profit and of essential service to mankind. If it could be brought into extensive commercial use for pavements and for the ordinary purposes of pitch and tar, Trinidad could easily furnish supplies for the whole world. Persons desirous of information connected with this lake will find good accounts in the *United Service Journal* for January, 1839, by Dr. Thos. Anderson; in Martin's "West Indies," vol. i. p. 191; by Mr. Alex. Anderson, quoted in M'Callum's "Travels in Trinidad," originally given, I believe, in "Transactions of the Royal Society," vol. lxxix. p. 65, and in *Fisher's Colonial Magazine*, vol. iii. p. 43 and 426. The most recent and best account will be met with in a paper by Mr. N. S. Manross, in *Silliman's American Journal of Science and Art*, vol. xx. p. 153 (No. for September, 1855.)

The Elastic Gums are among the most important and generally useful that come into commerce, and although at present confined to two varieties, there is no reason why additions should not be made to the list, and investigation promoted to elicit the comparative value of others. The rapid progress of the submarine telegraph, setting aside other important commercial uses of gutta percha, loudly calls for fresh supplies. If no other purpose had been subserved by this Indian gum than that of encasing the telegraph wires, mankind would have reason to be eminently grateful to the discoverers, and to the Society of Arts for the reward and publicity given to its merits.

We can all recollect when the only uses to which India-rubber was applied was to rub out pencil marks and make trap-balls for boys, but now it is made into shoes and hats, caps and cloaks, footballs and purses, ribbons and cushions, boats, beds, tents, and bags; into pontoons for pushing armies across rivers, and into camels for lifting ships over shoals. It is also applied to a variety of other uses and purposes, the mere enumeration of which would be tedious. New applications of it are indeed continually being made.

Boundless forests of the Serang tree are found upon the banks of the Amazon, and the exportation of this elastic gum from the mouth of that river is daily becoming a business of more and more value, extent, and importance.

Already within the past five years we have doubled our imports from Brazil (besides the large quantities which the United States draw from thence), and we have also increased our supplies of this elastic gum from the East, the imports from Singapore having risen from 559 cwt. in 1849, to 3,030 cwt. in 1853.

Of substances which may be used as substitutes to some extent for caoutchouc or gutta percha, the inspissated juices of the jack fruits and trees, those from the wild and cultivated bread fruit trees, and the lola tree may be mentioned.

Various species of Indian fig-trees, as *Ficus Radula*, *elliptica*, &c., also furnish portions of the elastic gum of commerce. *Vahea gummifera* likewise supplies caoutchouc. The *Urceola elastica* (which produces the Gintawan of the Malays) abounds on the islands of the Indian Archipelago; in Java it is called "bendud."

The concrete milky juice of the *Cryptostigeia grandiflora*—a handsome climber, common in the Madras Peninsula—has long been known to contain caoutchouc, but it has not yet been collected for the purposes of commerce, and it is doubtful if a sufficient quantity could be obtained to render it an article of trade. The milk from the cow tree appears to contain caoutchouc. It is supposed to be obtained from *Tabernæmontana utilis* of Arnot, or a species of *Brosimum*. On the river Demarara the Indians climb the rubber tree, tap the trunk, and as the gum exudes, rub it on their bodies till it assumes a sufficient consistency to be formed into balls.

Recent inquiry has shown that caoutchouc is furnished of good quality, by a large number of milky-juiced plants belonging to different families (*Sapotacea*, *Apocynaceæ*, and *Euphorbiaceæ*). In the East, Assam now furnishes large quantities of India rubber from *Ficus elastica*. Complaints are, however, made of the want of care in the preparation of the article from Assam.

If the previous purifying of the gum be properly attended to—and in this process the whole art of manufacturing the perfectly elastic gum of commerce seems to exist—the gum should not, by any exposure to the atmosphere, be subject to the least degree of clamminess or viscidity; and if this important point be not fully attained, the article is of no use in the manufacture of those fine elastic threads which constitute its chief value in the European markets. The art of obtaining this complete freedom from clamminess, and consequent perfect elasticity, does not appear by any means to have been reduced to a certainty; and, consequently, a far better acquaintance with the article than is yet possessed by the Assam manufacturers seems requisite before it can be obtained with constantly the same results.

A substance resembling caoutchouc was said to have been obtained in Sierra Leone from a plant of the Euphorbia tribe, so long ago as Tuckey's voyage up the Congo, in 1816. Some large forest trees, belonging to the Sapotaceœ family, which abound at the foot of the Ghauts, N.E. of Trevandrum, furnish a valuable elastic gum, called by the Malays pauchouthee, which bears a strong resemblance to gutta percha both in external appearance and mechanical properties, and the real *Isonandra gutta*, would appear to be common in the forests of the Neilgherries.

Gutta Percha has been discovered in the British province of Mergui, and though not precisely identical with the gutta percha of commerce, it possesses all the valuable properties of that substance, including plasticity in hot water, and the power of insulating electric currents.

The tree from which the true gutta taban is produced (erroneously misnamed in Europe gutta percha, a gum yielded by a different tree), is one of the most common in the jungles of Johore and the Malay Peninsula. It is not found in the alluvial districts, but in undulating or hilly ground. There is a great uniformity in the size of the full grown tabans, which rise with perfectly straight trunks from 60 to 80 feet in height, and from 2 to 3 feet in diameter, the branches being few and small. The natives, after felling the tree, make an incision round it, from which the milk flows. This is repeated at distances of 6 to 18 inches along the whole trunk. It appears that the taban, or milky juice, will not flow freely like dammer and caoutchouc, but rapidly concretes. Its appearance in this state before being boiled is very different from that of the article as imported into Singapore, and thence shipped to Europe. It has a dry ragged look, resembling shreds of bark, and instead of being dense and tough, is light, and possesses so little cohesion that it is easily torn in pieces.

Various statements are made as to the produce of each tree, which is somewhat surprising, considering the uniform size of the trees. The extremes mentioned are two catties and fifty catties. Dr. Oxley takes the average yield at ten catties, but probably five would be nearer the mark, hence it would take twenty trees to produce one picul of gutta, or 133lbs., and as the exports of gutta percha, from the commencement of the trade up to the close of 1853, have amounted to 3,107 tons, it follows that upwards of one million trees must have been destroyed to obtain that quantity in nine years. The natives, however, do not appear to be under any apprehension that the trees will be extirpated, and smile at the probability when suggested, for it is only trees arrived at their full growth, or at least at a very considerable age, that repay the labour of felling them and extracting the gutta, and those of all inferior ages which are therefore left untouched, will, it is supposed, keep up the race.

The collection of the gutta has widely extended, embracing now the Johore Archipelago, Sumatra, Borneo, and Java. Unfortunately the quality has deteriorated by the admixture of gutta percha, jelotong, gegrek, litchin, and other inferior gums, the products of different trees, which are often used to adulterate the taban.

The Gitah Lahoe is the produce of *Ficus cerifera*, Blume, which promises to be of great importance in an industrial point of view. The natives of Sumatra form torches of it, which burn with a clear flame, but make a great deal of smoke. A hydro-carbon, closely resembling Cullemundoo gum, from Jaulhna, was shown this year at Madras, obtained from *Euphorbia tirucalli*. It differs considerably from caoutchouc or gutta percha in its physical qualities.

The milky juice of the Muddar plant of India (the *Asclepias* or *Calotropus gigantea*), gradually dries and becomes tough and hard, like gutta percha. It thrives on the poorest soils, and also furnishes an excellent fibre, useful in the place of hemp and flax.

The juice of the sappodilla plum tree, the *Achras sapota* of the West Indies and South America is slightly adhesive to the touch, but it differs from gutta percha by becoming adhesive and extremely glutinous after being immersed in boiling water, while gutta percha immediately on exposure to a cooler temperature regains its original toughness and flexibility.

An elastic gum resin from an Australian Ficus was shown at Paris in the New South Wales collection, in small tears, of a dingy appearance, which might prove useful. A large portion dissolves in warm linseed oil, but spirits of wine does not act readily on it. By mastication it becomes tenacious and bleaches thoroughly.

The Royal Patriotic Society of Havana endeavoured to introduce the cultivation of the *Ficus elastica*, and other elastic gum-yielding plants into the island of Cuba, but their efforts seem not to have succeeded.

The Cullemundoo gum attracted particular attention in 1851, and the exhibitor was rewarded with a prize medal, from the impression of its adaptability to various purposes in the arts. It is obtained from the *Euphorbia antiquorum* of Roxburgh, and this year, at the local exhibition at Madras, the products of two other species, *E. Tirucalli* and *neurifolia*, received honourable notice, although the substances differed in their physical qualities from the true elastic gums of commerce.

An examination of the inspissated gum elastic juices of a number of trees from different localities, and prepared in a different manner, renders it probable that there are a variety of similar vegetable products yet untried, which may be advantageously introduced into commerce. They certainly deserve to be brought specially under the notice of our manufacturers, though as yet many of them are almost unknown to the very natives of the places where they are prepared. Gutta trap, the inspissated sap of an Artocarpus, obtained on the island of Singapore, and used for making birdlime, was favourably mentioned by the Jurors in 1851.

A few words on the medicinal gums of commerce will serve to bring this lengthy paper to a close.

Gum ammoniacum.—An opaque, cream-coloured gum, closely resembling in taste, smell, and general appearance, the ammoniacum of the shops, was gathered by the late Dr. Stocks, in Beloochistan, from the *Dorema aureur*, a tall, umbeliferous plant, described by him in Hooker's *Journal of Botany*, vol. 4, p. 149. He also found there the following fœtid gums, differing from the ordinary ones of English commerce. Gum resin of *Ferula orientalis*, Linn., in semi-transparent, yellowish brown tears, having a galbanum-like smell, and a strong, bitter, peculiar taste. From another species of Ferula he gathered a pale, yellow, waxy-looking, gum-resin, with a somewhat alliaceous and cubeb like taste. The average imports of ammoniacum in the last few years have been about 400 cwt. Medicinally it is considered the least powerful of the fœtid gum resins.

Euphorbia officinarum, *canariensis*, and some other fleshy species, produce the saline, waxy resin, called in the druggist's shops, gum euphorbium, which is the inspissated milky juice of the plant.

Asafœtida (*Narthex asafœtida*), according to the information of Dr. Falconer, who gathered it in among the Dardohs, a wild race of Central Asia, furnishes the Heeng, or asafœtida of commerce.

The plant is found in the greatest abundance in the Persian provinces of Khorassan and Laar, and thence extends on the one hand into the plains of Toorkistan, upon the Oxus, where it seems to have been met with by Sir Alexander Burnes, and on the other, stretches across from Beloochistan, through Candahar and other provinces of Affghanistan, to the eastern side of the valley of the Indus in Astore. Dr. Falconer did not meet with it in Cashmere. Captain Burslem, in his Journey in Toorkistan, states that the asafœtida shrub abounded on the hills, and they were almost overpowered by the horrible stench exhaled therefrom. It is collected in its wild state and sent to Cabul and India, yielding a good profit to those who pick it, as it is used very generally throughout the East for kabobs and curries.

Although these fœtid gums are now branded with all sorts of vile names for their offensive odour, yet they were in high repute among the ancients, asafœtida being reckoned one of the most agreeable seasonings for food, and highly esteemed for its medicinal uses, so that it was worth its weight in silver. A stalk of the plant was sent to the Emperor Nero, and yearly to Apollo of Delphos, as more precious than the other productions of the earth, insomuch, that "he is worthy of silphium," passed into a proverb, (silphium being one of the names by which it was formerly known.) Even in the present day, the Persians, and other Asiatics flavour their food with asafœtida, and term it the food of the gods. Tastes we know differ, for by some garlic is highly esteemed, while others detest its flavour. Asafœtida ranks high in the Materia Medica of the Chinese physicians. It forms an important article of trade in the East. The vessels that carry it to the Chinese ports from Bombay, are so imbued with the odour, that they spoil most other goods. Our annual imports of asafœtida range from 50 to 100 tons, but the greater portion is re-exported.

The gum resin called sarcocol is seldom now seen in the shops. It has the translucency and much the appearance of gum arabic. In Persia it exudes from all the parts of the *Penœa mucronata*, and in the Cape Colony it is said to be produced on the perianth of *P. Sarcocolla*, and other species of the shrub.

Gamboge.—This gum resin is imported to the extent of from 500 to 1000 cwt. annually, and is used in water-colour painting, and in medicine as a well-known cathartic. Our principal supplies are received from Singapore. Gamboge of good quality was worth there early in the year, 26 dollars the picul, equal to about £4 4s. the cwt. It may be obtained also from Ceylon, where it is produced by the *Hebradendron cambogoides*. The plants furnishing gamboge in other districts are not yet well defined.

Gamboge is obtained in Coorg, Mysore, Canara, Malacca, and Labuan. That from Malacca is the finest pipe variety, all the others are in the form of lumps or tears. The commercial character of this product may be altered by trivial circumstances, the exudation being yellow, reddish, or brown, and of different degrees of solidity, according to the season of the year and the method of manipulation.

The gamboge of the Madras peninsula has been found to be a useful pigment and an effective purgative. It has been lately added to the list of country medicines, and it appears that the tree is so abundant along the coast of the Ghauts, that the product may be obtained in very considerable quantities in the forests of Mysore, Malabar, and Canara. It has been collected there with much care in homogeneous masses, without air vessels, free of woody fibres or other impurities, and is produced by *Garcinia pictoria*, while that from Labuan is probably from *G. Cochin-Chinensis*.

Opium.—This well-known gum, the produce of the capsule of the poppy, enters largely into commerce in the East for stimulating and exciting purposes, and in Europe for medicine. The production in Bengal, chiefly for the supply of China, amounts to between five and six million a year! Our imports average from 150,000 to 200,000 lbs., and the home consumption has exceeded 60,000lbs. per annum, on the average of the last four years.

Gum Scammony is the milky juice, or gummy resinous exudation of a plant of the Convolvulus tribe, which is used entirely in medicine, and it is exceedingly difficult to get it genuine. The consumption is not large; the imports in 1853 were 9704 lbs., nearly all from the Turkish dominions.

There are one or two important articles of commerce, which, though not strictly gums or resins, but more properly inspissated extracts, deserve a passing notice, these are the Kinos imported for manufacturing and medicinal use. The Society of Arts early stimulated inquiry and investigation into these products, for the use of the tanner, dyer, &c., and in 1804 the gold medal was awarded to Dr. Howison, for certain useful extracts, and in 1824 Messrs. Pitchey and Wood, of Van Diemen's Land, also received the Society's Ceres Medal for other extracts. Sir Joseph Banks had some time previously drawn attention to the value of Terra japonica, or GAMBIER. This is an extract prepared from the leaves and branches of the *Uncaria Gambier*, of Roxburgh, cultivated chiefly at Singapore, by the Chinese, and of which our imports average upwards of 91,000 cwt. per annum.

The CUTCH of commerce, kuth, or catechu of India, is manufactured in the East from the heart and leaves of the wood of *Acacia Catechu*. Our imports of this substance for tanning, &c., amount to about 35,000 cwt. annually. The sources of supply are Burmah, Bombay, the Concan, and other parts of India. Of this astringent there are now large exports from the Madras territories. Last year (1854) they amounted to 1,369 cwts.

There are many samples from Madras, which may be reduced to three varieties:—

1. Circular flat cakes from Travancore, covered on both sides with paddy (rice) husks.
2. Large flat cakes, from the northern division, varying in colour from brickdust to dark yellow.
3. Round balls of a dark brown colour, the size of a small orange from Mangalore, where a large manufacture takes place. The exports of Cutch from Calcutta in the last two years have been as follows:—

	1855.	1854.
To Great Britain	26,624	27,084
France	8,712	2,812
North America	2,201	10,007
Indian Maunds...	37,537	39,903

Gambier from Rangoon comes in cubical cakes, covered with a malvaceous leaf.

The genuine GUM KINO of commerce is, as I have already stated, the natural exudation of *Pterocarpus marsupium*, and forms an article of export to the extent of a few tons from the Malabar coast. Gum Butea, from *Butea frondosa*, furnishes the Bengal kino nearly equal to the preceding.

The specimens I have seen are quite identical with the ordinary kino of commerce. Australian kino is obtained from the iron bark tree, a species of Eucalyptus. Jamaica kino from the *Cocoloba uvifera*.

Annual Imports and Estimated Value of the Gums, Resins, Balsams, &c., of British Commerce, including Gum substitutes and Vegetable Extracts:—

			£
Balsams, about 1,000 casks or packages		...	14,000
Liquorice Paste...	2,089 cwts.		
„ Juice...	9,775 „		
Turpentine	17,038 tons	... ...	170,380
Tar	24,500 „	at £6	147,000
Pitch & Petroleum	6,353 cwts.	at 50s. per ton	800
Rosin	23,000 tons	... ...	115,000
British Gum	3,000 tons	at £42	110,040
Lac Dye............	18,050 cwts.	at £11 ...	198,550
Seed Lac	402 „	25s. ...	503
Shellac	28,512 „	50s. ...	71,280
Stick Lac	3,000 „	30s. ...	4,500
Caoutchouc	27,588 „	£7 ...	193,116
Gutta Percha......	21,792 „	£5 10s. ...	119,856
Terra Japonica, or Gambier.........	4,550 tons	at £25 ...	113,750
Cutch...............	1,700 „	£30 ...	51,000
Aloes	110 „	£60 ...	6,600
Amber	37 cwts.	... ...	
Ammoniac.........	28 cwts.	at £2	56
Anime and Copal	6,000 „	16s. ...	96,000
Arabic	61,614 „	50s. ...	153,535
Asafœtida	400 „	30s. ...	600
Benjamin	900 „	£12 ...	10,800
Dammer	1,300 „	50s. ...	3,250
Dragon's Blood...	190 „	£6 ...	1,140
Galbanum	24 „	£11 ...	264
Gamboge	341 „	£5 ...	1,705
Guiacum	20 „	£7 ...	140
Kino	250 „	£2 ...	500
Mastic...............	430 „	£22 10s. ...	10,125
Myrrh	230 „	£3 ...	690
Opium	159,312 lbs.	at 10s. ...	79,656
Olibanum	10 000 cwts.	at £2 ...	20,000
Sandarac	230 „	70s. ...	805
Scammony.........	9,704 lbs.	at £2 ...	19,408
Senegal	9,000 cwts.	at 45s. ...	20,250
Tragacanth	70 tons	at £5 ...	350
Unenumerated Gums............	6,000 cwts.	at £2 ...	12,000

The aggregate market value of these articles, therefore, at the current prices of the day, approximates to two millions sterling.

The following works and papers may be consulted by those desirous of further investigating the subject of gums and resins, &c.:—

For the medicinal gums, resins, and vegetable juices—

Lindley's Flora Medica. Longmans.
Brande's Dictionary of Materia Medica. Parker.
Brande's Manual of Chemistry. Parker.
Ure's Dictionary of Chemistry. Tegg.
Thomson's London Dispensatory, by Dr. Garod. Longman.
Dr. Royle's Manual of Materia Medica. Churchill.
Gray's Supplement to the Pharmacopœia, by Redwood Renshaw.
Dr. Pereira's Materia Medica. Part II. Longman.
A Treatise on Foreign Vegetables, chiefly taken from Gregory's Materia Medica, by Ralph Thicknesse, M.D. London, 1749.
Dr. O'Shaughnessy's Bengal Dispensatory. Calcutta.
Thomson's Organic Chemistry—Vegetables. London: Baillière.
Pomet's Histoire des Drogues. Paris.
Paper on Production of Opium in Asia Minor, by Mr. Maltass. Pharmaceutical Journal, Vol. XIV., p. 395.
Dr. Little on the Preparation of Opium. Journal of the Indian Archipelago, Vol II., p. 1. Singapore.
Milburn's Oriental Commerce [contains good accounts of the Eastern Gums, &c., but they are old]. Allen and Co.
Lindley's Vegetable Kingdom. London: Bradbury.
Archer's Economic Popular Botany—Chapter on Gums. London: Reeve and Co.
Poole's Statistics of Commerce. London: W. H. Smith.
Knight's Industry of all Nations [contains a good account of the Gums under their alphabetical names].
Lowig's Principles of Organic Chemistry; for the Composition of the Resins. 1853. Spon, Bucklersbury.
Jury Reports of the Great Exhibition; East Indian Catalogue; Jamaica Catalogue, and Madras Catalogue of Articles shown at the London and Paris Exhibitions.
The Annual Parliamentary Papers on Trade and Navigation for the Statistics of Import and Consumption, also a Monthly List, published by Smith, Hart-street, Mark-lane, for the Imports, Stocks, and Consumption of many of the minor articles not particularised in the Parliamentary trade returns.
Some Recent and Trustworthy Information on the Gums and Gum Resins of Africa and Arabia will be found in a series of Articles by Mr. James Vaughan, of Aden, in the Pharmaceutical Journal, vol. XII., p. 226, et seq.
On Gutta Percha, Caoutchouc, &c., by Dr. Adriani. Ibid, vol. X. p. 546.

Caoutchouc and Gutta Percha; abstract of a Lecture by Professor Calvert. Pharmaceutical Journal, vol. XII., p. 453.

———— on extraction of, by M. Weddell. Ibid, vol. XV., p. 116.

The Indian Rubber of the Amazon, by R. Spruce. Ibid, 117.

On the Plant yielding Gutta Percha, by Sir W. J. Hooker. Pharmaceutical Journal, vol. VII., p. 179.

On various applications of Gutta Percha, by Mr. Weston. Pharmaceutical Journal, vol. VIII., p. 141.

———— by Mr. E. Solly. Ibid, vol. V., p. 510.

Several extracted articles on Gutta Percha. Ibid, vol. VI., p. 376.

Article on Gutta Percha, by Dr. Oxley. Journal of Indian Archipelago, vol. I., p. 22.

Paper by J. A. Logan on the Range of the Gutta Taban Collectors. Ibid, vol. II., p. 529.

Camphor Tree of Sumatra, by Dr. Vriese, Pharmaceutical Journal, vol. XII., p. 22, and by Sir W. J. Hooker, ibid, p. 300.

On the Chemical Examination of Kino, by Henning. Pharmaceutical Journal, vol. XIII., p. 77.

On Kino from Moulmein, by Dr. Christison. Pharmaceutical Journal, vol. XII., p. 377.

On Kino, by A. Gibson. Ibid, p. 497.

The Kino of Western Africa, by Dr. Daniell. Ibid, vol. XIV., p. 55.

On East Indian Kino, by Dr. Royle. Ibid, vol. V., p. 495; and by Rev. F. Mason, ibid, vol. VIII., p. 387.

On Resin and Resin Oil Manufacture. Pharmaceutical Journal, vol. XII., p. 345-389.

On the Scammony of Smyrna, by Mr. Maltass. Pharmaceutical Journal vol. III., p. 264, and by Mr. Hanbury, p. 268.

On the Test of its Purity. Ibid, vol. XIV., p. 38.

On Tragacanth and its Adulterations [a valuable paper], by Mr. Maltass. Ibid, vol. XV., p. 18.

On Gum Mezquite. Chemical Gazette, by Dr. Morfit, No. 297, 1855; reprinted in Pharmaceutical Journal, vol. XV., p. 42.

On the Constitution of the Resins, by Johnson. Philosophical Transactions.

On the Frankincense Tree of Western Africa, by Dr. Daniell. Pharmaceutical Journal, vol. XIV., p. 400.

———— of Sierra Leone, by Mr. Bennett. Ibid, p. 251.

On the Hog Gum Tree, by Dr. Hamilton. Ibid, vol. VII., p. 270.

On Gum Ammoniacum, and Indian Copal. Ibid, vol. II., p. 773.

Chemical Analysis of Myrrh. Quoted in Pharmaceutical Journal, vol. V., p. 376.

On the Tree yielding African Olibanum, by Dr. Royle. Ibid, vol. V., p. 541.

On the Resins of Xanthorrhœa Hastilis, by Dr. Stenhouse. Ibid, vol. VI., p. 88.

On the Gamboge of the Tenasserim Provinces, by the Rev. F. Mason. Ibid, vol. VII., p. 398.

On the Gamboge Tree of Siam, by Dr. Christison. Ibid. vol. X., p. 235.

On the Manufacture of artificial Gums or Dextrine. Newton's London Journal, No. 179; and reprinted in the Pharmaceutical Journal, vol. VII., p. 138.

On Australian and Turkey Gums, by Dr. Hopff. Pharmaceutical Journal, vol. VII., p. 588.

Liquid Amber Tree of the Tenasserim Provinces. Ibid, vol. VIII., p. 243.

On the Purification of Gum Arabic, by H. Picciotto. Ibid. vol. IX., p. 16.

On the Resin of the Norway Spruce Fir, by Mr. D. Hanbury, jun. Ibid. vol. IX. p. 400.

On the Balsam of Pine and White Balsam, by Dr. Pereira. Ibid, vol. X., p. 290, 280.

DISCUSSION.

The Chairman said that they had all heard the elaborate and interesting statements on this important matter. He was sure that there were many persons present able to make valuable remarks on the subject, and equally sure the members of the Society would be glad to hear them.

Mr. Conybeare said there was one point in the admirable paper of Mr. Simmonds worthy of great attention, viz., the attempts to economise manufactures in which gum was used, by the employment of gum substitutes. He thought they ought to discourage as much as possible the use of articles of human food in the preparation of manufactures to make them sell better, it being well known that the dextrine only gave an appearance to cotton which washed out. Mr. Simmonds had alluded to the large quantity of flour used in cotton manufactures as a substitute for gum. As an example of this he might state that a short time since he went over one of the largest cotton manufactories in the kingdom, the extent of which they might imagine when he told them that it employed 1,500 hands, and the proprietor, a most intelligent man, told him that the cotton manufactured there eat up as much flour as would feed the whole of the hands in the establishment. He thought that this Society ought to express an opinion that such a waste of human food should be discouraged. This dextrine, so far from adding value to the cotton, absolutely deteriorated it; and the wife of the manufacturer to whom he had alluded knew this so well that she would not have it used in any cotton intended for her own consumption. As had been well stated the other day by Prince Albert, at Birmingham, the most pleasing part of science was that which rendered the greatest benefit in improving and economising the cost of manufacture.

Mr. Hyde Clark felt they must all be obliged to Mr. Simmonds for his valuable paper, and no gentleman better understood the subject, he being the author of a standard work on The Commercial Products of the Vegetable Kingdom. The industry and research of Mr Simmonds proved the value and importance of a commercial museum, for which the Society of Arts had laboured; and they were much indebted to Professor Solly and Mr. Simmonds for their exertions in this direction. There could be no place like a Trade Museum for watching the change of fashion, and showing what article chemical science might enable them to substitute for another, should there be a great rise in price or a dearth of produce in any particular article. He hoped the valuable collection laid before them that evening would stimulate them in their exertions to support the Trade Museum to be established at the West-end by the Exhibition Commissioners, and also that which Mr. Simmonds was endeavouring to found in the City. However important and valuable a museum might be at the West-end, merchants could not run away from their business in the middle of the day to examine it if they wished to know any particular thing. Of course persons who dealt in an article knew its value, but there were many articles, of which the public knew nothing, the dealings in which were confined to two or three houses, and in which large speculations took place to the injury of the public, who did not know what would be its proper substitute.

Mr. Hilton believed that the rise in the value of resins, alluded to by Mr. Simmonds, was principally owing not to any difficulty in procuring them, but to the rise in the freight. These resins came over in barrels, weighing say, two cwt., and a rise of 2s. 6d. to 5s. per cwt. in freight, raised their commercial value from 5 to 7, and even 800 per cent. He did not know what was the value of dextrine, but he knew that gum arabic had been lately as low as 21s. the cwt. He was not aware whether gum arabic could be used in place of dextrine, but if so, it would depend upon the value of the latter article.

Mr. Simmonds said the best was about 40s. the cwt.

Mr. Hilton thought they might rely upon it that any supply of gum arabic might be obtained from 23s. to

36s. per cwt., and if so, they could hardly say dextrine was used as a gum substitute.

Mr. **Rea** had often paid 56s. per cwt. for it.

Mr. **Sparkes Hall** having said a few words on the value of indiarubber and gutta-percha for the manufacture of shoes and goloshes,

Mr. **Pearsall** said, without going into statistics, one great advantage arising from the use of starch substances in manufactures, had been to find a ready and very profitable market for all kinds of damaged flour and grain, and it was now almost impossible to find any damaged grain in the food market. For the damaged grain a price nearly equal to that paid for the superior kind was realized.

The **Chairman** said the paper just read by Mr. Simmonds had afforded them ample materials for the evening's consideration. The question of gums and resins was one of universal application. Resin was an ingredient in the fabric of nearly all plants; gum was another, and there was no perfect plant in which both resin and gum were not present, the difference being, that some plants had gum in excess, others resin, while others had both in excess, the superfluous quantity being thrown off in the shape of excretions. The chief source of the production of gums and resins would be hot countries, such climates being peculiarly favourable for their production. The long list of gums and resins brought before the notice of the meeting by Mr. Simmonds might be greatly extended; in fact, the supply might be said to be inexhaustible. With regard to the objection raised to converting articles of food into dextrine, or gum substitute, it must be remembered that this took place at the expense of the starchy matter of plants. It occasionally happened that some plants were extremely poisonous, and their starch could not be used for the purpose of food, but it might be separated for conversion into gum. What had been mentioned by Mr. Pearsall, viz., that damaged flour was just as good as the finest grain that could be procured for manufacturing purposes, was explained by the fact just adverted to. So long as grain was damaged by circumstances which merely affected its condition as an article of food, the starch remained unaltered, and, therefore, it was clear that samples which have no commercial value as food, were perfectly well adapted for the making of dextrine. In the case of the potato blight a short time back, although the potato became decayed and altogether unfit for human consumption, nevertheless, all the starch grains remained, if not altogether unchanged, at least very little altered. Therefore, the most inferior kind of potatoes, such as are given to pigs, were as capable of yielding starch for the purposes of dextrine, as those of a finer and better description. It was possible that this part of the subject might not be generally understood, and it, therefore, seemed worthy the notice of the meeting—to do away with an impression that none but the best articles were applicable for making dextrine. In conclusion, he begged to move a vote of thanks to Mr. Simmonds for the elaborate and useful paper he had read upon the important subject before the meeting.

Mr. **Simmonds** in thanking the meeting for the manner in which the paper had been received, said that he was enabled for the most part, from his own private collection, to illustrate all the ordinary gums and resins of commerce, but for some exceedingly fine samples and rare specimens, he was indebted to the kindness of Messrs. Rea, Wallis, D. Hanbury, jun., Walker, Harding, S. Hall, and Hemming.

The Secretary announced that the paper to be read at the meeting of Wednesday next, December the 5th, was "On the Construction of Private Carriages in England; and on the Carriage Department of the Paris Exhibition," by Mr. G. N. Hooper. On this evening the Earl of Shelburne, M.P., will preside.

To Correspondents.

The Secretary has been requested by the Chairman of the Council, to publish in the *Journal*, that the statement in his recent address to the Society on the opening of the Session, to the effect that Mr. Chadwick had been employed by the Emperor of the French to Superintend the Sanitary improvements in a quarter of Paris, was founded on a misapprehension.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst. 2. General Monthly Meeting.
London Institution, 7, Mr. John Ella, "On Music, Vocal and Instrumental."
Architects, 8. Adjourned Discussion on a Diploma in Architecture.
Chemical, 8.
Entomological, 8.
Tues. Civil Engineers, 8, Mr. Evan Hopkins, "On the Gold-Bearing Rocks of the World."
Linnæan, 8.
Pathological, 8.
Wed. London Institution, 3, Mr. Robert Bentley "On the Reproductive Organs and Classification of Plants."
Society of Arts. 8, Mr. G. N Hooper, "On the Construction of Private Carriages in England; and on the Carriage Department of the Paris Exhibition."
Geological, 8. 1. Mr. R. W. Banks, "On the Tilestones, or Downton Sandstones in the neighbourhood of Kington, and their Fossil contents." 2. Mr. D. Sharpe, "On the last Elevation of the Alps, with Notices of the Heights at which the Sea has left traces of its action on their sides."
Thurs. London Institution, 7, Mr. W. Odling, "On the First Principles of Mechanical Philosophy."
Antiquaries, 8.
Photographic, 8.
Royal, 8½.
Fri. Philological, 8.
Sat. London Inst., 3, Mr. Thomas A. Malone, "On the Elementary Principles of Vegetable and Animal Chemistry."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette November* 23rd, 1855.]

Dated August 29th, 1855.

1953. John Hanson, Doagh, Belfast—Improvements in machinery or apparatus for digging or working land, and removing roots or plants therefrom.

Dated September 6th, 1855.

2019. James Fraser, Jermyn-street—Improvement in the manufacture of paper.

Dated October 13th, 1855.

2291. John Durance, Barge-yard, Bucklersbury—Improvement in the frames of pianofortes.

Dated October 27th, 1855.

2398. Henry Wyatt, 58, Pall Mall—A peculiar apparatus for more rapidly and perfectly manœuvring or steering steam ships of war or of commerce, which is entitled The Transpulsor.

Dated October 29th, 1855.

2411. John Kennard, 32, Little Queen-street, Holborn—Improvement in the manufacture of childrens and invalids' carriages.
2413. Germain Jean Paul Marie Villeroux, Paris—Improvements in the manufacture of soap.
2415. John Henry Johnson, 47, Lincoln's inn-fields—Improvements in regulating the transmission of motive power. (A communication.)

Dated October 30th, 1855.

2417. Paul Emile Chappu's, 69, Fleet-street—Improvements in reflectors for the diffusion of artificial light.
2419. William Naylor, Norwich—Improvements in power hammers and rivetting machines.
2421. Thomas Hocroft, Tividale, and Richard Forrest, Tipton—Improvements in the manufacture of iron rods, bars, hoops, merchant and guide iron.

Dated October 31st, 1855.

2423. William Henry Walenn, 46, Regent-street—Self acting attachment to be applied to gates. (A communication.)
2425. James Gray Lawrie, Glasgow—Improvements in ship building, to facilitate the use of water as ballast.
2427. Henry Edwin Drayson, Maresfield Powder Mills, Sussex—Improvement in the manufacture of gunpowder.
2429. Thomas James Swinburne, South Shields—Improvements in furnaces or apparatus used in the manufacture of glass.
2431. Richard Pannell Forlong, Bristol—Improved manufacture of manure.

Dated November 1st, 1855.

2435. Henry Laxton, 19, Arundel-street, Strand—Improvements in gearing for increasing or decreasing rotary speed. (A communication.)
2437. George Milner, 13, Hollen-street, Wourdour-street, St. Ann's, Westminster—Improvements in the manufacture of bedstead

bottoms, part of which improvements are applicable to various other purposes for commercial and domestic use.

2439. William Taylor, Haughton, near Shifnal—Improvements in the manufacture of iron.

2441. Joseph Bentham, Bradford—Improvements in looms for weaving.

2443. Robert Keer, Glasgow—Improvements in spinning together fibrous materials of different kinds.

2445. William Henry Walenn, 46, Regent-street—Improvements in pianofortes. (A communication.)

Dated November 8th, 1855.

2518. Louis Gasté, 58, Paradis Poissonnière, Paris—Improvements in binding account and other books.

Dated November 9th, 1855.

2522. George Barry Goodman, and George Alfred Webster, 21, York-buildings—Improvements in apparatus for reflecting the back, front, and sides of the figure and head in a mirror or toilette glass at one view.

2524. James Bramwell, Royal Exchange-buildings, and John Crawford, Newcastle-upon-Tyne—Improvements in ordnance.

2526. Charles Joseph Hampton, Llynrivale, Llangynwyd, Glamorgan—Improvements in the manufacture of iron.

Dated November 10th, 1855.

2528. William Peter Piggott, 523, Oxford-street—Improvements in galvanic, electric, and electromagnetic apparatus, and in the mode of applying the same as a curative and remedial agent.

2530. Joseph Scott, Glasgow—Improvements in corking bottles, jars, and other receptacles.

2532. Alfred Vincent Newton, 66, Chancery-lane—Improvements in transmitting fac-simile copies of writings and drawings by means of electric currents. (A communication.)

2534. Henry Wickens, 4, Token House-yard, Bank—Improvements in locomotive steam engines, and in apparatus in connection therewith, parts of which improvements are respectively applicable to other steam engines and purposes.

Dated November 12th, 1855.

2536. Jules Cesar Alexander Bouillotte, Paris—Improved letter copying press.

2538. William Kemble Hall, 36, Cannon-street—The prevention of steam boiler explosions.

2542. John Yull Borland, Manchester—Improvements in spinning, and machinery for preparing and spinning fibrous materials.

2544. Joshua Kidd, 75, Newgate-street—Improvements in machinery and apparatus for sewing or stitching and ornamenting cloth or other fabrics.

2546. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in casting metals. (A communication.)

2548. William Carr Thornton, and Benjamin Thornton, Cleckheaton—Improvements in machinery or apparatus for preparing and spinning wool, which improvements are also applicable to washing and wringing machines for the same material.

Dated November 13th, 1855.

2552. Julius Homan, Milk-street, Cheapside—Improvements in machinery for cutting up woven and other fabrics.

2554. William Webb and John Webb, junior, and James Catstree, Birmingham—Improvements in attaching door knobs to spindles.

2556. Frederick Abraham Eskell, Manchester—Improvements in plates for attaching artificial teeth.

2558. William Foster, Black Dike-mills, near Bradford—Improvements in machinery or apparatus for drying wool and other fibrous materials.

Dated November 14th, 1855.

2560. Henry Laxton, 19, Arundel-street, Strand—Improvements in fire-arms. (A communication.)

2562. Thomas Skinner, Sheffield—Improvements in producing figures or ornaments upon the surfaces of metals.

2564. Cyprien Marie Tessie du Motay, Paris—Improvements in the manufacture of lubricating materials.

2568. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improved safety coal-hole cover. (A communication.)

2570. Edmond Godefroid Cox, Lille—Improvements in picking or cleaning cotton, wool, and other filamentous substances.

Dated November 15th, 1855.

2574. John Talbot Pitman, 67, Gracechurch-street—Improvements in the construction of iron beams and girders, and in machinery for making the same. (A communication.)

2576. Joseph Lester Hinks, Birmingham—Improvements in brushes.

2578. William Lea, Wolverhampton—Improvements in taps or cocks.

2580. Duncan Morrison, Bordesley Works, Birmingham—Improvements in the manufacture of articles with internal screws, when cast iron, malleable cast iron, or cast brass is employed.

WEEKLY LIST OF PATENTS SEALED.

Sealed November 23rd, 1855.

1157. Johan Jacob Meyer.
1165. William Smith.
1166. William Smith and Nathaniel Fortescue Taylor.
1167. James Atkinson Longridge.
1179. Joseph Addenbrooke.
1191. Frederick Herbert Maberly.
1193. Thomas Mather.
1200. Auguste Edouard Loradoux Bellford.
1202. Theodore Marie Rabbatte and Jacques Rettig.
1206. François Theodore Botta.
1252. Peter Armand le Compte de Fontaine Moreau.
1334. John Henry Johnson.
1898. John Macintosh.
1416. William Edward Newton.
1516. Julian Arnold Bellay.
1548. Joseph Wilson.
2002. Warren De la Rue.
2012. George Peacock.
2024. Richard Archibald Brooman.
2066. John Macintosh.
2132. Charles Manby and William Piper.

Sealed November 26th, 1855.

1213. John Morrison.
1215. Eugene Michel Roch.
1221. Henry Grafton.
1239. Emanuel Wharton.
1246. Samuel Bickerton.
1247. Antoine Bernard Alfred Baron Espiard de Cologne.
1270. Horace John Kaye and Percy Burrell.
1273. Edmund Morewood and George Rogers.
1275. William Edward Newton.
1283. Thomas Burrows.
1296. John Boucher.
1299. John Ramsbottom.
1319. Thomas Bright.
1321. Joseph Robinson.
1336. John Joseph Liebisch.
1349. Edward Rush Turner and Frederick Turner.
1355. George Arthur Biddell.
1358. Ebenezer Hollis.
1379. Louis Henri Real.
1418. John Louis Jullion.
1425. Richard Keevil.
1472. John Raywood.
1513. Richard Archibald Brooman.
1637. Mathieu François Isoard.
1877. Alfred Savage.
1985. James Timmins Chance and Henry Adcock.
1995. Cyrus Clark and James Clark.
2001. Charles Gustav Mueller.
2006. William Southwell.
2035. Thomas Hemsley and William Hemsley.
2057. Matthew Curtis and John Wain.
2061. John Macintosh.
2065. Benjamin Barber, John Butterfield, and Thomas Austin.
2077. George Dewdney.
2165. Thomas Barrows.

WEEKLY LIST OF PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

November 19th.

890. Mathurin Jean Prudent Moriceau.
1070. Clement Dresser.
1174. David Clovis Knab.

November 21st.

884. Robert Barnard Feather.

November 22nd.

847. Henry Thomson.
850. William Henry Winchester.
865. Charles Harford.
919. James Barlow.
939. James Newall.

November 23rd.

853. Stephen Spalding.
867. Charles Iles.
983. John Henry Johnson.
985. William Mayo.
991. Thomas Lovell Preston.

November 24th

870. James Ward Hoby and John Kinniburgh.
887. Thomas Wood.
942. Peter Walker and Andrew Barclay Walker.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3786	November 22.	Solocorum	Key and Co.	Charing-cross.
3787	" 26.	Gas Torch	James Jones and Son	Bow street, Covent-garden
3788	" 27.	Perpetual Office Almanack	Francis Jackson	Derby.
3789	" "	Part of a Photographic Camera	Arthur James Melhuish	Blackheath.
3790	" 28.	Clasp Fastening	Turner and Pegg	Leicester.

Journal of the Society of Arts.

FRIDAY, DECEMBER 14, 1855.

FOURTH ORDINARY MEETING.

Wednesday December 12, 1855.

The Fourth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 12th inst., Chandos Wren Hoskyns, Esq., in the chair.

On the table were exhibited some specimens of Indian Fibres from Mr. Watson, and two blocks of Preserved Coal from Mr. Wood, particulars of which will be given in the succeeding numbers of the *Journal*.

The following candidates were balloted for and duly elected:—

Aston, Theo.
Coulson, William
Tracy, John

The paper read was:—

ON THE PROGRESS AND RESULTS OF THE UNDER-DRAINAGE OF LAND IN GREAT BRITAIN.

By J. Bailey Denton.

In selecting the subject of drainage as a topic for consideration, at a moment when war and its consequences upon the corn producing countries of Europe have brought the price of wheat to 11s. 6d. per bushel, and the price of bread to 10d. the loaf, the Council of this Society have been doubtless influenced by a desire to extend the knowledge we possess of an art which has been rightly esteemed the foundation of agricultural improvement, and the most simple and certain means by which the produce of the soil may be increased.

If we consider the deprivations which seem to be multiplying upon us, we shall be led to appreciate more sensibly the importance of the present inquiry, and we shall be struck with the fact, well known, but too little reflected upon, that in proportion as extremely high prices move the community at large to desire that the capabilities of our native soil should be more fully developed, in order to increase its produce of food, so do many owners of that soil abate their zeal in pursuit of improvements necessarily admitted, though but partially performed, during the more pressing difficulties of extremely low prices.

If this should sound like mere assertion, the evidence afforded by the expenditure in drainage, under the Government loan, will leave no doubt on the point, for in 1852, when wheat was 40s. 9d. the quarter, the expenditure was £412,269 15s. 6d. It became in 1853, when wheat rose to 53s. 3d. per quarter, £334,115 13s. 3d.; and declined still further in 1854, when the price was 72s. 5d. per quarter, to £316,220 7s. 4d., or about £100,000 less than in 1852.

This fact, in its reference to the particular subject of drainage, is the more to be lamented, because the operation may be considered essentially to rank among the obligations of the owner and not the occupier of the land, and it is so necessary to found the present discussion upon a right understanding of this important point, that I must be pardoned for dwelling upon it.

It is hardly 12 months ago since I had an opportunity of introducing this subject to the attention of the London Central Farmers' Club, the members of which are for the most part tenant farmers; and it was then suggested to me, that however convincing the evidence might be in proof of the profitable results from systematic drainage, and however interesting in themselves the details of the necessary operations, it was so manifest that drainage, to be satisfactory, must be done effectually and permanently, and must therefore involve such a much larger outlay than a tenant farmer could be expected to make, that my statements should be rather addressed to the owners than to the occupiers of land.

The whole tenor of the discussion on that occasion went to show, that considerations of *expediency* were paramount with those whose interest in the soil was limited by the nature of their tenancy, while it was contended that *principle* should rule with those whose interest in the soil was permanent and secure.

This practical view and treatment of the subject could hardly be reprehended, when it is remembered that whereas the average amount of capital employed by occupiers in the cultivation of the inferior wet lands of Great Britain may be estimated not to exceed £6 per acre, the cost of permanently draining these lands would amount to about £5 per acre, so that if the tenants who farm them were to apply their capital at once to this fundamental work, they would be left with only £1 per acre to provide for all the other expenditure on their farms.

If this is so, the proposition becomes reduced to a practical absurdity, for the average amount of capital actually employed in the cultivation of the inferior heavy lands, is known to be insufficient to secure even creditable or profitable treatment, irrespective of draining; and to require a tenant to bury a portion of his already insufficient capital beneath the soil in drainage under such circumstances, can only lead to the injury of both his landlord and himself.

Up to the passing of the first act for the advance of public money for the purpose of draining, in 1846, the operation of draining, or bush-gripping, as it was more appropriately called, was looked upon as an act of husbandry to be performed by those tenants who had sufficient capital to undertake it at a cost of from 30s. to 40s. per acre.

Though the drainage lasted but 12 or 14 years, the outlay was proved to be remunerative, and such draining was recognised by custom in several counties as an improvement entitled to compensation between outgoing and incoming tenants. Now, so long as the intelligence of the country remained insensible of the manifold advantages of deeper draining, and so long as the operation was covered by an outlay of 30s. or 40s. per acre, we can readily understand that little necessity existed for any participation of the landowner, but as soon as it was established that the best effects of draining depended upon permanency of execution, and could only be gained by an outlay approximating £5 an acre, the matter assumed much more serious proportions. It was no longer a simple process of husbandry. The act of the tenant, dictated by self-interest, rightfully became the act of the landlord, ruled by principle. The only thing wanted was the means of borrowing money, and of adjusting the outlay between present and future owners in cases where the existing owner had but a limited interest in the land.

Mr. Pusey's act, of 1840, was the first public effort made to meet this want, and although the act itself, from its complications, remained inoperative, it effectually established the principle of enabling landowners with limited interests to borrow money for draining, and to charge it upon the lands improved. Mr. Pusey's act, however, was followed in 1846 by the first public money drainage act, and, subsequently, by other acts, including the Private Money Drainage Act, and the three several acts for incorporating the existing private companies.

The desideratum of money was thus fully supplied, and it is much to be regretted that greater use has not been made of the facilities so afforded, particularly during years like the present, when high prices are making tenants more than ever solicitous to increase their profits by having draining done, and when they will gladly pay the interest by which the cost will be liquidated, as well as a proportion of the extra expense of doing it at a period of scarcity. I am led to these remarks because I am made daily cognizant of the fact that there are many landowners who, being deterred by the present high prices of labour and materials, are contented to receive their rents without default, and leave the work of drainage to be done inefficiently by the tenant, or defer it to a time when they may possibly be obliged to do it without receiving interest, for it is manifest that the time is not very distant when clay lands will be deemed untenantable so long as they remain undrained.

The several acts referred to gave different powers, but all confirmed the rule that under-drainage was the legitimate work of the owner, and that the only contribution to be made by a tenant should be the payment of the annual instalment by which the cost may be repaid in a given number of years. Beyond establishing this equitable arrangement between landlord and tenant, the obligation enforced on the borrower of money, to show that "the improved annual value shall exceed the amount of annual charge by which the cost of drainage shall be repaid," furnished a very wholesome and just criterion by which any landowner may be guided in the outlay of his own money in draining. In fact, the principle involved in this obligation should be made the rule in every case of improvement. It is not sufficient that an owner spending his own money should get simple interest, he must get so much more than interest as will enable him to establish, if he thinks proper, a sinking fund to repay him his capital within the period for which the work will last, —or the projected improvement is not worth doing.

But as the fulfilment of this principle involves a compact between two parties, the owner who provides or borrows the capital to execute the work, and the tenant who repays it with interest, it is desirable to adopt every means to reduce the annual instalment as low as is just and equitable, without decreasing the efficacy of the work, in order that the tenant may feel that, *in adverse as well as in prosperous times*, he will be able to pay it. To reduce the instalment, it is necessary to lengthen the term for repayment of the money expended, but this can only be done consistently with the durability of the works. The object, therefore, to be arrived at by both parties is to secure the best effect with the utmost durability. Already it has been made apparent that the short term of 22 years, with all the advantage of the low rate of interest of the Government loan, has necessitated a charge upon the tenants which many, even of the most enlightened, are indisposed to bear as a standing increase of rent,—or it has caused dissatisfaction on another and worse ground, viz., that the works themselves have been inefficiently done, from a predetermination to limit their cost to such an amount as will be repaid by a given charge.

I refer to the experience of this fact, because it is manifest that the extension of the art of draining will very materially depend upon the rate of instalment charged upon the tenants, and however profitable individual cases of drainage may be shown to be, the benefit to the nation will be unappreciable, unless we satisfy the tenants generally that during all the vicissitudes of times they can afford to pay the increased rent they are to be charged. The advantage of a lengthened period will be shown by comparing the increased rent a tenant would have to pay to liquidate the expenditure of £5 per acre in 50 years and 25 years. In the former case the increased rent would be from 4s. 6d. to 5s. 3d. per acre,* and in the latter from 6s. 6d. to 7s. 2d. The difference is nearly 50 per cent. Now if drainage is substantially done, there is no reason whatever to doubt that it will last at least 50 years, and it follows, therefore, that the time for repayment may extend, if need be, to that period. (See Note at end of paper.)

In saying thus much on behalf of the general advantage of keeping down the annual charge, I have been led to do so more from a desire to assist in determining who are the proper parties to perform the work of under-draining, than from a wish to underrate the benefit or profit arising from it.

I am in possession of some remarkable instances of the increase of produce, but it would answer no good purpose to give the details now.

I may, however, state in general terms that while many of my correspondents speak of the increase from draining as one-fourth of the produce grown on the same land in an undrained state, *none lay it at less than four bushels per acre*. Some lay great stress on the advantage of doing away with summer fallowing, and in prolonging the wheat seeding time in autumn, and in gaining an earlier fortnight in the spring and at harvest-time, estimating the gain in these respects at a greater amount than the increase in cropping. Some farmers dwell on the reduction of horse-labour; others, again, on the convertibility of drained land, and the capability of folding upon it;—showing, most satisfactorily, that it is not necessary to stretch after every item of gain to enable a tenant to pay a fair per centage on the cost. But among the many facts and opinions I have collected, I know of none that will carry with them greater weight than those afforded by Mr. Hutton, of Gate Burton, in Lincolnshire, whose practical knowledge of agriculture is so well known to all. The following is a letter I have received from him:—

"Gate Burton, November 21, 1854.

"My dear Sir,—As our drainage contract is now nearly completed, I think you will be desirous to know my opinion of the way in which the work has been carried out, as well as the results. I am very glad to be able to give you a most satisfactory report of both. The soil, as you know, is generally clay, with a more porous clay subsoil at a depth of about 3ft. 6in. We have strictly carried out your principles, viz, a minimum depth of four feet, as few out-falls as possible, all of which are well-protected by brickwork, and grated iron outlets, with a fall into the open ditch of not less, if possible, than six inches. It is only common justice to Mr. Wright, who has carried on the work under your superintendence, to say that it is scarcely possible that it could be better done, and I am very willing, nay anxious, to submit it to the closest inspection. With regard to the results, the improvement is wonderful. Where four horses have frequently had considerable difficulty in ploughing, sheep are now eating off a good crop of turnips; and on the old grass land, formerly scarcely of any value to the tenant, the improvement is still greater, as it is now producing excellent crops of wheat, worth almost the fee simple of the land in an unimproved state. —Yours very truly, "W. HUTTON."

I may observe that a large proportion of Mr. Hutton's drainage was done in substitution of shallow draining.

To understand clearly the advance made in underdraining, and the extent of work yet to be done, the whole country should be divided geologically into three great characteristic areas, viz., the western and north-western or Alpine district of primary and transition rocks; the middle district of secondary strata, exclusive of, and up to the lower margin of the chalk; and the eastern and south-eastern district, comprising the chalk of the upper secondary strata, the Wealden and the tertiary and post-tertiary deposits overlying the chalk. There are several outlying portions of the formations thus classified which will be found beyond the line of division, but they are so small as not to interfere with the general arrangement.

A curved line drawn from Exeter to Berwick will make a very close give-and-take division between the western and middle districts; and the lower margin of the chalk, commencing at Weymouth in Dorset, and ending at Flamborough Head in Yorkshire, will form a

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* Five shillings per acre increased rent will be met by the following increase of produce, upon a 4-course system of husbandry, independent of all benefit from the improved condition of the soil for tillage and seeding:—

Turnips,	20	bushels	at 3d.	per	bushel.
Barley,	1¼	"	4s. 0d.		"
Beans,	1⅓	"	3s. 9d.		"
Wheat,	¾	"	6s. 8d.		"

defined boundary between the middle and eastern districts.

1st. The western and north-western or Alpine district includes the mountainous granite, mica, and slate rocks with the trap rocks, clays,—and debris associated with them,—and the conglomerate, clay, and loam of the old red sandstone which cover a wide breadth of the lower lying portions of the district.

The district is made up as follows:—

TABLE I.

Name of County.	Extent of each County included in district.	Extent of Land cultivated and Land capable of improvement.	Proportion of wet Land.	Amount of Money applied for under the Public Money Drainage Act.	Amount expended under the Act.
	Acres.	Acres.	Acres.	£.	£.
Cornwall	851,200	680,000	255,000	63,702	27,040
Devonshire, part of Somersetshire, part of	1,657,200	1,215,000	400,000		
Wales, part of	4,000,000	2,997,000	1,250,000	223,863	83,297
Monmouth Worcester Hereford Salop — parts of	1,315,040	1,215,000	750,000		
Lancashire Yorkshire Northumberland Westmoreland Cumberland — parts of	1,035,000	565,000	360,000	1,941,168	1,165,683
Scotland, part of	18,000,000	9,628,390	5,000,000		
Outlying portions in the Midland district	35,840	20,000	10,000		
Total A	26,894,280	16,320,390	8,025,000	£2,228,733	£1,276,020

The system of drainage applicable to this district being for the most part occasional or "spring drainage," the expenditure will be brought rather below the cost of parallel or uniform draining. Where parallel drainage has been deemed necessary in the valleys of the granite district, the cost has been generally high, owing to the large quantity of boulder stones and rock fragments which crowd the debris of which the soil is constituted.

In the clay slate valleys, too, the cost has been found to be very great, owing to the necessity of breaking through and blasting protruding rocks, frequently bringing the cost as high as £7 or £8 per acre.

The drains in the hill sides, however, being at comparatively wide intervals will be executed at from £2 10s. to £4 per acre, and the average cost of the whole will thereby be much reduced. It may be assumed that the quantity of land permanently drained in this district by means of borrowed capital and by private outlay, does not exceed 500,000 acres, and that £35,000,000 will be required to perfect the under-draining of the remaining 7,525,000 acres of wet land.

2nd. The middle district, including all the secondary strata from the basis of the Devonian, Cambrian, and Cumbrian ranges up to, but exclusive of, the chalk formation, comprises the mountain limestone, the coal measures, the new red sandstones, and magnesian limestone, the lias, the oolitic strata, and the portion of the green sand with the gault lying to the west of the main ridge of chalk. In these several formations, clays abound sometimes of very considerable width and thickness, and sometimes only thick enough to act as a parting between beds of porous rock, sand, and gravel. Boulder, or transported clays, frequently cover the foundation rock and out-cropping clays.

The following counties, parts of counties, and parts of Wales and Scotland, (See Table II.) make up the middle district:—

This district, consisting of nearly nineteen millions of acres, comprises soils of every degree of tenacity and porosity, from the stiffest clays to the freest sands. About one-half or eight millions of acres of the cultivated lands, and lands capable of improvement, are believed to be either clays or loams requiring drainage on the parallel system, with more or less distance between the drains, and about 3¾ millions of acres are of comparatively porous matter, which require occasional drains, or drains at very wide intervals, to free them of the water upheld by the underlying clays. Some of the stiffest clays, however, particularly patches of the red sandstone clay, some deep beds of the lias and Oxford clays, and the gault, require very close drainage to be effective. An interval of six to eight yards is quite wide enough for these soils. The necessity of thus increasing the number of drains in some places will counterbalance the comparatively small cost of the occasional drainage of the water-logged strata, and will bring the average cost of the whole to £5 per acre. We cannot assume that there are less than ten millions of acres in this district still to be drained. This is, supposing that 415,000 acres have been already permanently drained, and on such assumption it will require £50,000,000 to perfect the under-draining of the district.

3rd. The eastern district includes the chalk (the uppermost formation of the secondary strata)—the green sand which surrounds the Weald clay—the Wealden clay, and Hastings sands, the London and plastic clays,—the Bagshot sand and associated clay,—the crag of Norfolk and Suffolk, the rich deposits of Holderness in Yorkshire, and the more recently recovered fens of Norfolk, Cambridgeshire, Huntingdonshire, and Lincolnshire. Boulder and transported clays are very frequently found in this district also, covering the out-cropping strata.

The following counties or parts of counties (See Table III.) make up the district:—

A very wide portion of this district is chalk, and requires no draining. A considerable portion, too, consists of the fens, of which I have estimated only half as requiring under-draining. Already the prejudice against under-draining these lands is giving way, where the vegetable matter is shallow and the underlying clay comes closer to the surface. The deep peat, or "black fens," may be considered sufficiently well-drained by open dykes, and have not been included in the foregoing statement. I may remark, however, that where under-drainage has been tried, it has been found to consolidate the soil and improve the quality and weight of the corn grown. The whole breadth of the fens in the several counties is about

700,000 acres. Of the denser clays, we have in this district the Wealden and the London clays; the former of which covers 650,000 acres, and the latter 1,500,000 acres, all of which requires parallel and close drainage. Besides these clays, we have a very large space covered with the clays and loams of the Bagshot sand, and with boulder and diluvial clays of every degree of tenacity.

TABLE II.

Name of County.	'Extent of each County included in district.	Extent of Land cultivated and Land capable of improvement.	Proportion of wet Land.	Amount of Money applied for under the Public Money Drainage Act.	Amount expended under the Act.
	Acres.	Acres.	Acres.	£.	£.
Devon ... Somerset Dorset ... parts of	1,200,000	1,170,000	650,000	252,678	125,955
Gloucester Monmouth Worcester Salop and Wales...... parts of..............	2,434,080	2,340,000	1,350,000		
Lancashire........ Yorkshire......... Morthumberland Westmoreland... Cumberland...... parts of.......	5,920,120	5,387,000	3,000,000	704,831	442,062
Durham	702,080	650,610	400,000	106,174	64,101
Scotland, parts of	1,352,320	1,200,000	700,000	640,000	314,000
Lincolnshire Norfolk...... Cambridge.. Huntingdon parts of	1,321,040	1,286,000	800,000	158,133	70,113
Bedford ...... Buckingham parts of	488,640	450,000	250,000		
Oxford Berks.. Wilts.. parts of	1,020,000	965,000	600,000		
Warwick..	574,080	525,000	350,000	20,525	16,189
Northampton	650,240	620,000	375,000	27,208	13,108
Rutland	95,360	90,000	40,000	100	
Leicester..	500,000	480,000	250,000	17,385	12,155
Nottingham	535,680	510,000	300,000	39,792	16,952
Derby	657,920	590,000	300,000	9,550	3,261
Stafford..	757,760	720,000	550,000	39,200	28,930
Cheshire	673,280	630,000	500,000	37,104	23,234
Total ....A	18,882,600	17,613,610	10,415,000	£2,052,680	£1,130,080

TABLE III.

Name of County.	Extent of each County included in district.	Extent cultivated and capable of improvement.	Proportion of wet land.	Amount of Money applied for under the Public Monies Drainage Act.	Amount expended under the Act.
	Acres.	Acres.	Acres.	£.	£.
Dorset Wilts. Berks. Hants. Oxford parts of	2,203,840	2,130,000	600,000	55,473	21,313
Bucks and Beds, parts of	280,000	265,000	250,000		
Cambridge and Hunts, parts of..	546,560	519,000			
Hertford	403,200	375,000	300,000	18,750	17,363
Middlesex	180,480	160,000		10,625	3,176
Surrey	485,760	450,000	1,300,000	29,155	13,155
Sussex..	938,240	900,000		52,768	22,253
Kent	996,480	940,000		23,020	8,293
Essex	981,120	940,000	650,000	21,805	6,782
Suffolk........................	969,600	920,000	700,000	8,990	5,495
Norfolk, part of	1,285,360	1,215,000		18,260	6,853
Lincoln, part of	600,000	550,000	600,000	35,000	18,000
Yorkshire, part of	450,000	425,000			
Outlying portions on the Western side	254,480	235,000	50,000		
Total ....A	10,575,120	10,024,000	4,450,000	273,846	122,683

As the metropolis and suburbs are included in this district, I have assumed that 450,000 acres have been permanently drained, leaving 4,000,000 acres requiring draining, the cost of which cannot be estimated at less than £22,000,000.

The following summary gives the totals of the districts:

TABLE IV.

DISTRICTS.	Total Extent.	Extent cultivated and capable of cultivation.	Proportion of wet land.	Amount of money expended under the Public Money Drainage Act.	Amount of money expended under the Private Money Drainage Act.	Estimated Amount of money expended by Incorporated Companies.	Estimated extent of Land drained permanently by borrowed money and by private means.	Extent still remaining to be drained.	Estimated amount of capital required.
	Acres.	Acres.	Acres.	£.	£.	£.	Acres.	Acres.	£
Western and North-Western District	26,894,280	16,320,390	8,025,000	1,276,020	128,723	350,000	500,000	7,525,000	35,000,000
Midle District	18,882,600	17,613,610	10,415,000	1,130,080			415,000	10,000,000	50,000,000
Eastern District............	10,575,120	10,024,000	4,450,000	122,683			450,000	4,000,000	22,000,000
Total......................	56,352,000	43,958,000	22,890,000	2,528,783	128,723	350,000	1,365,000	21,525,000	107,000,000

I have to thank the Inclosure Commissioners for the figures I have quoted relating to the advances under the Public and Private Money Drainage Acts. Having transposed them for my own purpose, I think it best to give the totals with which they have so obligingly furnished me in another form. They are brought up to the 31st October last:—

TABLE V.

	PUBLIC MONEY						PRIVATE MONEY					
	Applied for.			Expended.			Sanctioned.			Expended.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
England	1,940,227	11	6	1,059,804	0	0	292,056	0	0	111,098	0	0
Wales	123,863	0	0	44,297	2	1						
Scotland	2,491,167	16	6	1,424,682	17	6	72,083	0	0	17,625	0	0
	4,555,258	8	0	2,528,783	19	7	364,139	0	0	128,723	0	0
To expend				1,471,216	0	5						
Total amount of loan				4,000,000	0	0						

Thus we see that there will still be required £107,000,000 for the under-drainage of Great Britain, towards which the balance in hand of the Government Loan, £1,471,216, is applicable, leaving the sum of £105,528,784 to be provided from private sources. Of this it may be assumed that four-fifths, or about £80,000,000, will be required on loan, and that the collected capital of incorporated drainage and insurance companies will be the future source of supply; for it is hardly to be supposed that the legislature will again sanction the advance of public money for the particular benefit of one class of the community, after experience has shown that private companies are able and willing to lend money upon the lowest rate of interest ruling in commercial affairs.

The sum of £80,000,000 appears large when placed in juxta-position with the Government loan of £4,000,000; but, when compared with the sums expended in other national enterprises, such as the £286,068,794 expended within the last twenty-five years by railway companies, it cannot be so regarded, particularly if we remember that 3½ per cent. is above the average interest now gained by railway investments; whereas, in drainage advances, not only would the capitalist be made secure of the current interest of money by a first charge on the freehold itself, but both the owners and occupiers of land would derive a paramount advantage from an enterprise in which they practically run no risk and advance no capital. And, while this result would be gained by individuals, the community would be benefited by an increase in food, by drainage alone, which cannot be estimated in the aggregate at less than 5,330,000 quarters of the several kinds of corn which constitute the country's produce.

The public loan being all bespoken, the means of borrowing money now at command of landowners are:—The Private Moneys Drainage Act (12 and 13 Vict., cap. c.), the term for repayment being 22 years; the West of England, or South West Land Draining Company's Act (11 and 12 Vict., cap. cxlii.), under which a landowner may charge his estate in perpetuity; the General Land Drainage and Improvement Company's Act (12 and 13 Vict., cap. xci.), the term for repayment being 50 years; and the Lands Improvement Company's Act (16 and 17 Vict., cap. cliv.), the term of repayment being 25 years.

Having explained how under-draining became the obligation of the landlord, when it was converted from a temporary to a permanent work, and having shown the source whence borrowed capital is to be obtained, and how little progress we have made in comparison with what still remains to be done, I will pass to those results which the actual practice of the last ten years afford, and which will influence our future mode of executing works of drainage.

In order to trace the progress now making towards the realization of that adequately deep drainage which Dr. Lyon Playfair has so well described in the article "Theory of Drainage," in the Cyclopædia of Agriculture, we must have reference to the relative merits of the several methods which have been propounded in direct opposition to or as a compromise of the principle of depth.

First on the list is the shallow-draining system, which admits the use of pipes in lieu of bushes, but adheres to drains 18 to 24 inches deep in the furrows, as the quicker means of getting rid of water falling on the surface, than drains laid at a greater depth. I do not propose to dwell very long on this system, for so numerous are the instances throughout Great Britain of the complete success of deep draining, when properly executed, and so generally is deep draining now substituted for shallow draining, that it is difficult to admit of a compromise of depth under any circmstances whatever. But as the advocates of shallow draining have been enabled, by certain defects in the development of the deep-drainage system, to maintain a position for a time, it is advisable to trace at once the causes of such defects, that we may not be led away from true principles by accident or the influence of prejudice. We cannot hide from ourselves that the operations under the first Public Money Drainage Act were stimulated by erroneous notions of economy. It was thought that the greater part of our clay lands would be drained at a cost of £3 or £4 per acre, or even less, and to this delusion may be attributed the greater part of the defects which have brought discredit on the system. Experience has shown that the average cost of adequately deep drainage is as near as possible £5 per acre, although at this time the general increase in the price of labour and materials has increased it to about £5 15s. 0d.

Drainage, to be perfectly satisfactory in its effect upon the soil, must render it uniformly permeable to the full depth of the drains. The soil midway between them must be in the same condition to receive and infiltrate the rain that falls upon it, as the soil nearest the drains. If this be not accomplished, they are not producing that united effect which should be sought for and obtained, and there is no more certain way of producing *an irregular condition of soil*, than by placing the drains so far distant from each other, that the influence of one drain cannot perfectly meet the influence of another.

Cases have been quoted as failures of deep-draining, in which a desire to keep down the cost has led to an indiscreet widening of the distance; and the unsatisfactory result to which I have referred, following that indiscretion, has proved that the increased depth of drains will not compensate for increased distance, and that soils which should be drained 24 feet apart, cannot be sufficiently well drained at 40 feet apart, let the depth be what it may. But the effect has been no other than this,—the principle of depth has remained unshaken. It has simply proved that good draining is not to be done for as little money as bad.

Among the instances of this species of partial failure, I may state that I have been obliged in several instances to introduce intermediate drains when I have been over careful of expenditure, and have placed those first laid out 30 feet, where they ought to have been 25 feet apart.

Mr. Gow, of Morpeth, writing to me last year said, "I have had one or two failures in deep-draining, where, from a desire to economise, I have placed the minor drains at too great a distance apart; and I find, too, that some of our earlier performances, at a depth of three feet, will require to be re-drained at a greater depth."

It is a common assertion, "that water cannot get down through clays," but in no one instance has it been successfully shown that water will disobey the laws of gravitation, or will fail to descend through *any clay soil, however absorbent and retentive*, to an approximate level with drains of reasonable depth (not less than four feet), *if they be placed sufficiently near each other* to counteract such absorbent and retentive properties, and to meet the effect of atmospheric humidity in maintaining them in force.

Frequently has it fallen to my lot to meet men retaining prejudices in favour of shallow draining, on clays which they have declared to be so stiff and retentive, that it was impossible water could find its way down, and so dense and dry in the subsoil, that no water could be gained from cutting into it. These clays have nevertheless been drained from four to five feet deep, and water has flowed copiously from the outlets; still the advocates of shallow draining, when asked "from whence comes the water?" reject this simple proof of their error.

In the same way they refuse all evidence of the superior effect of deep drains afforded by the facts that they generally commence running *before* shallow drains; that they invariably run as soon and *more copiously* than shallow drains; that they continue to run long *after* the shallow drains have ceased to run; and that they discharge *clear* water, while the shallow drains discharge discoloured water, showing how perfectly the former act as a means of conveying to the subsoil (which the shallow drains hardly penetrate) a proportion of the manure the farmer has taken the pains to put on his land, but of which he is robbed by his shallow drains. If the advocates of shallow draining cannot adduce any instance of the failure of deep draining, it cannot be said that no instance can be found in which shallow draining has failed to keep even the surface of land dry, leaving out of consideration the many benefits incidental to deep drainage, and which are altogether lost sight of, but which are of equal importance with drainage itself.

The following extract of a letter will show that land carefully drained 18 inches deep with tiles, becomes, in a few years, as wet or even wetter than before.

It is from Mr. Macvicar, of Barkwith, in Lincolnshire. He says—

> "I have met with several cases of shallow drainage which at first have been followed with beneficial results, and have become after a time inoperative. Thus, in the parish of Colsterworth, a field of strong retentive clay land was drained in 1842, at a depth of 18 inches; for a time the land was apparently laid dry, but in succeeding years it showed symptoms of returning wetness.
>
> "I saw the field last week; it is sown with wheat, and, although water-furrowed, the land is saturated with water. I examined the outlets, which were running very slowly, although I believe the drains are open."

I have never yet heard a satisfactory reason for land returning to a state of wetness after being dry. One thing, however, is proved by Mr. Macvicar's case, and that is, that it is not merely by the substitution of the durable pipe for the perishable thorn that the surface of land can be rendered permanently dry, as the shallow drainers say. It will be observed that it is about 14 years since this specimen of *permanent* shallow draining was done. This length of time accords with the period which is generally understood to be the time which elapses before bush-draining would be renewed. Now, I have often heard the remark from farmers who were about to renew this latter description of draining, that they could not account for the land becoming so wet as to require re-draining, when their drains which were put in 12 or 14 years back were open and running, but such was the case; and I believe it will be found that pipe-draining 18 inches deep, will be as little durable as bush-draining of the same depth; for whether it be from increased succulency of the surface soil, or from any other cause this discussion may elucidate, it is certain that time will render shallow drainage useless without any rupture of the drains themselves.

Before leaving the shallow-draining system, I will take the liberty of referring to a circumstance which, I trust, will prove to Mr. Bullock Webster, who has long advocated shallow-draining, that he has been misled, and by that he has inadvertently misled others.

In 1850, Mr. Webster published, in the *Journal of the Royal Agricultural Society*, a short paper, headed "Mischief arising from Draining Clay Soils too Deeply," and without giving any proof whatever of the mischief to which he referred, he gave currency to what the agent of the Duke of Wellington was doing, and quoted a letter, signed by Mr. Charles Easten, in which he said it was intended never again to put a drain upon the heavy clay at Strathfieldsaye at a greater depth than three feet. I presume he meant to convey that these clays could not be drained effectively at four feet deep or more. It fortunately happened that the Speaker of the House of Commons, whose estate at Heckfield is intermixed with that of the Duke, determined in 1852-3 to drain a portion of his estate. He employed the General Land Drainage Company to do the work for him, and instead of draining at Mr. Easten's depth of three feet, the Company have not laid a single drain less than four feet deep, and the major portion have been laid four feet six inches and more.

So prejudiced were the tenants against deep drainage in the first instance, that they threw obstacles in the way, and the Speaker kindly limited the work to one farm. When this was done the tenants, one and all, begged that the wet lands of their several farms might be drained, and the Speaker thereupon entered into a second contract for several hundred acres, allowing them to select, as far as was practicable, the lands they called "*wet*." On the completion of this second contract, the tenants, with the same unanimity, but with increased earnestness, begged to have the very lands drained they had withheld as dry, and not requiring draining, because they found by comparison with the drained land—the "*mischievously*" deep-drained land—that the excepted dry land was insufferably wet, and to oblige his tenants, the Speaker has just entered into a third contract.

I have passed over the clays of Strathfieldsaye, and I can recognise no difference between them and the clays of Heckfield.

I will not dwell upon the tangible evidence the instance affords of the efficacy of deep drainage, nor the contradiction it gives to the reputed "mischief" arising from the practice.

It must be manifest, I hope, to Mr. Webster and to those who generally agree with him.

As an advance upon the extremely shallow drainage of 18 inches and 24 inches depth, we find Mr. Denison, Mr. Milward, and several other gentlemen of high repute, draining from 2 feet 6 inches to 3 feet deep, and they still, I believe, express themselves satisfied with the result; but, as drains of the medium depth of 2 feet 6 inches to 3 feet cannot fail to do some good (and, perhaps, a lasting one, so far as the discharge of water goes), the fact that the result has been satisfactory to those who performed the work, does not prove that such medium depth is the best. On the contrary, I hope, by referring to a few facts, to show that drainage as shallow as 30 inches or 36 inches, fails to provide for all the objects in view.

Three important advantages attend deep drainage beyond the primary object of discharging superfluous water. The first is—the increased quantity of soil ameliorated and rendered serviceable to vegetation; the second—its improved temperature; and third—the removal of the pipes beyond the reach of deep cultivation, and beyond the reach of *annual* vegetation, to stop the drains by the growth of roots within them. With regard to the first advantage, it can hardly be necessary to say that the staple of aërated soil, into which the roots of plants can travel and seek their food, cannot be too deep. Every inch of additional drainage gives 100 tons of active soil per acre, rendered, by drainage, so free and porous, as to gain fertility from the rain passing through it, and from the solution of the ingredients of the soil, and from the manure which is brought down from the surface by the rain.

I published recently some very curious illustrations of the dislike plants exhibit for stagnant water in the soil. They afforded proof that directly the roots reach the standing water level, they ceased to penetrate further. I have evidence now before me that the roots of the wheat plant, the mangold wurzel, the cabbage, and the white turnip, frequently descend into the soil to the depth of three feet. I have myself traced the roots of wheat nine feet deep. I have discovered the roots of perennial grasses in drains four feet deep; and I may refer to Mr. Mercer, of Newton, in Lancashire, who has traced the root of rye grass (which is daily coming more and more into cultivation) running for many feet along a small pipe drain after descending four feet through the soil. Mr. Hetley, of Orton, assures me, that he discovered the roots of mangolds in a recently-made drain five feet deep; and the late Sir John Conroy had many newly-made drains four feet deep stopped by the roots of the same plant.

These facts are mentioned to show that the roots of our cultivated crops do descend and appropriate the soil to as great a depth as they are permitted, and we have proof, too, that the greater range of active aërated soil we can give them, the more prolific and weighty is the grain they produce. This has been satisfactorily shown at Yester. By deep cultivation the produce of the wheat crop there has been increased from three quarters and six bushels, to five quarters and four bushels, and the weight per bushel in proportion. Instances could be given of advantages arising from the removal, by deep draining, of the injurious presence of oxide of iron which is known to pervade many of our clay soils, but I refrain from multiplying cases which may appear at all speculative or incapable of proof.

Upon the second point, the temperature of the soil, we have at present no positive evidence to show that any advantage is gained by increasing the depth beyond three feet, but it cannot, nevertheless, be doubted, that the deeper the drainage which regulates the height of stagnant water in the soil, the more likely it is that excessive evaporation, and its chilling effects in the soil itself, will be prevented. Mr. Parkes has clearly shown, in his admirable paper in the 5th Volume of the *Journal of the Royal Agricultural Society of England*, the loss of heat by evaporation of water in undrained land. The experiments carried on at Yester, show, that in winter a higher temperature of 2° 25' was gained by draining, while in summer there appeared to be no gain. By the act of deep cultivation, however, in addition to draining, a gain was effected of 2° in summer and 4° 25' in winter. In this case the drainage was only 33 inches deep, and the comparisons of heat were not made on the same land before and after draining, but on adjoining lands. What would be the effect of an adequately deep drainage has not yet been communicated, though I believe that experiments are in progress which will show that a higher temperature can be produced than any that has attended drainage only 33 inches deep.

But as a proof of the sensibility of a soil drained four feet deep to atmospheric changes, I may mention that my attention has been on more than one occasion called to the circumstance that drains have been observed to run after a discontinuance of that duty without any fall of rain on the surface of the drained land, and upon reference to the barometer, it has been found that the quicksilver has fallen whenever this has occurred. Mr. George Beaumont, jun., who first afforded tangible evidence of this extraordinary circumstance, has permitted me to read the following extracts of his letter:—

> "I can verify the case of the drains running without rain during a falling barometer beyond all doubt.
>
> "The case I named to you last year of the barometer falling four days consecutively, and with rapidity, was a peculiarly favourable time for noticing it, as it occurred in a dry time, and the drains could be seen distinctly. My man, on being questioned and cautioned by me not to exaggerate, has declared the actual stream of water issuing from one particular drain to be as thick as a ⅛-inch wire. All the drains ran—they did more than drop—and ditches which were previously dry became quite wet, with a perceptible stream of water; this gradually ceased with the change in the density of the atmosphere, as shown by the barometer.
>
> "During last harvest, 1855, the men were cutting wheat, and on getting near to a drain outlet, the ditch from the outlet downwards was observed to be wet, and the drain was dripping. No rain fell in sufficient quantity to enter the ground. The men drank of the water while they were cutting the wheat. A few days after it was dry again. I have seen and noticed this phenomenon myself."

A correspondent of the *Agricultural Gazette* has stated that Professor Brocklesby, of Hartford, in America, had observed the same phenomenon in the case of two springs in that country, and explained that the cause was "the diminished atmospheric pressure which exists before a rain."

With respect to the third point, I wish to avoid speculative views as to the extreme depth to which cultivation may reach, but I believe with the present mode of subsoil ploughing (without the aid of steam-power which is advancing upon us) a depth of from 17 to 22 inches is gained; it is, therefore, obvious, that pipes laid 18 inches deep would be lifted by the plough, and it is not improbable that when we have the aid of steam-power, pipes laid 24 inches deep will be moved as readily. With these anticipations it would be a very bad provision for futurity if the owner of entailed property called upon the next generation to contribute to the cost of draining at any depth which 20 years hence may appear as shortsighted as drainage 18 inches deep is now deemed to be. It is true that pipes laid 3 feet deep may not be directly touched by the instrument of subsoil ploughing, but we have evidence of the disposition of the roots of plants to thread their way through *stirred* soil 4 and 5 feet deep, and of the stoppage of pipes by the roots of cabbages, mangold wurzel, and turnips, at a depth of 3 feet, *where the soil is firmly consolidated.* With this experience it must be admitted that the insecurity of 3 feet drainage will be increased by subsoiling, and that therefore the adoption of such a medium depth may operate as a bar to an improvement which may become a natural sequence to draining.

I trust that these few remarks—difficult to condense—in explanation of the collateral and secondary benefits of deep drainage, will serve to show, that in the aggregate, they are of equal importance to the primary object of discharging injurious water, and that any system of drainage which does not provide for them is imperfect as a permanent work.

With these observations I will pass to that system of draining which has recently acquired the title of the *Keythorpe system.* Allowing for a difference in the mode of carrying it into execution, this method is based upon the same principle as Mr. Baker, of Writtle, has enunciated, viz., that if there be a porous soil only 2 feet deep, resting on an impervious subsoil, nothing is gained by carrying the drains into the latter. All practical men—I mean practical men, *qua* drainage—will at once dispute the assumption that there exists any clay subsoil at a depth of 2 feet below the surface which is impervious, and that, therefore, any system founded on it is nothing more nor less than an indirect mode of shallow draining, aiming only at the discharge of water, without seeking any of those collateral advantages just referred to.

The Keythorpe system, which has been very ably explained by Mr. Joshua Trimmer, the eminent geologist, in the *Journal of the Royal Agricultural Society*, is brought before agriculturists with the flattering recommendations of cheapness and scientific treatment. Lord Berners, the owner of the Keythorpe estate, having certain lands in hand, commenced his draining operations by causing numerous holes to be dug. By observation and experiment, which appears ultimately to have led to a definite practice, his lordship was enabled to arrange his drains so far distant from these holes as just to suffice to draw the water out of them. Mr. Trimmer explains the mode adopted to be a system of draining by pipe channels transverse to certain ridges and furrows, found to exist between soil and subsoil, or, to use the words of Mr. Trimmer, "between the warp drift and the erratic tertiaries of the older strata, on which the warp drift rests" with a view to intercept the water which finds its way through the porous warp drift into the furrows; these furrows acting, in fact, as *minor* drains to the transverse channels, which act as *sub-mains.*

The characteristics of the system are:—

Firstly. That the drains are neither equidistant nor of regular depth, their position and depth being determined by the shape of the subterranean undulations and the depth of the furrows.

Secondly. That the drains cross the line of greatest descent (obliquely) in order to intercept the water flowing down the furrows referred to, "which are generally found," Mr. Trimmer says, "on land with a considerable fall, and run, in most cases, in the direction of the fall; and,

Thirdly. That the efficacy of the drainage depends upon a precise knowledge of the breadth and depth of the ridges and furrows.

Without venturing to deny the statement of so sound a geologist as to the existence of these subterranean ridges and furrows, and without presuming to deny that Lord Berners has rendered his land dry for the time being, I am content to state what appear to me insuperable objections to the general adoption of the Keythorpe system. The first is, that the depth of the drainage must necessarily depend upon the depth of the furrows, whether they be 18 inches or 10 feet deep (if they are found to exist of sufficient regularity to become applicable as drains at all). We have the evidence of what has been done at Keythorpe, showing that they are sometimes found to lie only 18 inches deep, one-tenth of the drains being that depth.

If, therefore, Lord Berners should follow the example of the Marquis of Tweedale, and determine to subsoil this drained land next year to a depth of 22 inches, he would not only plough up all his 18-inch pipe drains, but, inasmuch as he would decapitate and deform the ridges alternating with the furrows (which are his minor drains), the destruction would not be limited to the 18-inch drainage, but would extend to the major part of the work. The second objection is, that the direction of the pipe drains is across the fall of the land, and, therefore, opposed to the influence of gravitation; and the third is, that there exists no tangible data generally applicable for setting out the pipe drains.

In many instances I am satisfied that the knowledge Mr. Trimmer has made peculiarly his own, would be not only beneficial to landowners, but might frequently assist draining engineers in solving problems in nature, which correct geological knowledge alone can solve. But I do not think it will afford tangible data for the execution of drainage works, particularly those in which expedition forms an item of profit, as is generally the case.

The next system which intervenes as a compromise with the principle of depth, is that of the late Lord Wharncliffe. It is called the combined system of deep and shallow drainage, and has been described by his lordship, in the *Journal of the Royal Agricultural Society*, in the following terms:—

> "In order to secure the full effect of thorough drainage in clays, it is necessary that there should be not only well laid conduits for the water which reaches them, but also subsidiary passages opened through the substance of the close subsoil, by means of atmospheric heat, and the contraction which ensues from it. The cracks and fissures which result from this action, are reckoned upon as a certain and essential part of the process.
>
> "To give efficiency, therefore, to a system of deep drains beneath a stiff clay, these natural channels are required. To produce them, there must be a continued action of heat and evaporation. If we draw off effectually and constantly the bottom water from beneath the clay and from its substance, as far as it admits of percolation, and by some other means provide a vent for the upper water, which needs no more than this facility to run freely, there seems good reason to suppose that the object may be completely attained, and that we shall remove the moisture from both portions as effectually as its quantity and the substance will permit. Acting upon this view then, after due consideration, I determined to combine with the fundamental four feet drains a system of auxiliary ones of much less depth, which should do their work above, and contribute their share to the wholesome discharge, while the under current from their more subterranean neighbours should be steadily performing their more difficult duty.
>
> "I accomplished this by placing my four feet drains at a distance of from eighteen to twenty yards apart, and then leading others into them, sunk only to about two feet beneath the surface (which appeared upon consideration to be sufficiently below any conceivable depth of cultivation), and laying these at a distance from each other of eight yards. These latter are laid at an acute angle with the main drains, and at their mouths are either gradually sloped downwards to the lower level, or have a few loose stones placed in the same intervals between the two, sufficient to ensure the perpendicular descent of the upper

stream through that space, which can never exceed, or, indeed, strictly, equal the additional two feet."

In order to give you the most authentic account of the results of this system, I will read you the following extracts from a letter I have just received from Mr. William Hunt, of Wortley:—

"I am now able to give you my opinion of the success of the same system of draining upon the Carleton property, belonging to Lord Wharncliffe. The combined system has succeeded most admirably there. The soil generally is a strong loam for about one foot in depth, then a stiff clay subsoil, but I found on making trial pits in several parts of each field, that at the depth of about 3½ feet, and between that and 4 feet, the clay was a little more porous, although below that depth it became quite stiff. I, therefore, set out the 4 feet drains according to his lordship's usual practice, by 20 yards apart, with the 2 feet drains slanting into the 4 feet at 8 yards apart.

"The tenants were at first much averse to the combined system, but they are now highly in favour of it in preference to the regular system at whatever depths, and they are now preparing to sow turnips next season where such practice was never thought of previously. The rapid manner in which the surface has become dry after the heaviest falls of rain, has quite surprised all parties who have witnessed the effects of the combined system of draining at Carleton. *I have no doubt but 4 feet drains, placed at regular distances, would have drained the land I have named, but the cost would have been much higher, and what is of greater importance than the expense?*

I desire to draw your particular attention to the last paragraph of this letter. My kind correspondent could hardly have made a more candid admission of the influence of expediency.

It would only be repeating the observations already made, were I to explain the several objections with which practical drainers regard this system. I may shortly observe, however, that no one would contradict that the lands were improved by the method of draining adopted, simply because it would be impossible to deny, as I have before implied, that any drain, even two feet deep, could be put into land without doing some good, but it is equally impossible to reconcile with any laws of hydraulics, engineering, or economy, the union of the two depths in one system. The drains of the greater depth must detract from the utility of those at the less, and the two directions, *with* the fall and *across* it, cannot both be right. The numerous junctions, too, are liable to constant disarrangement. It would appear that, by adopting an uniform depth of three feet six inches (which, although not so good a depth as four feet, is a respectable depth), at intervals of 25 feet, a much more permanent drainage could have been secured for £5 an acre (a sum to which Lord Wharncliffe limited himself), than by any method of which a depth of two feet is an element, if the advantages of uniform aeration and deep cultivation are recognised, considerations which Mr. Hunt would apppear to have overlooked in the question with which the quotation closes, and which shows clearly that the combined system is simply one of expediency.

I have avoided the subject of spring draining, because all practical men seem to agree on the principle of action, and the length to which this paper has already extended forbids any further enlargement.

Having described the several systems of shallow draining, semi-shallow draining, subsoil furrow or Keythorpe draining, and the combined deep and shallow draining, we now approach that of the adequately deep draining, and a consideration of the means by which that object is to be obtained at the least cost. But let me premise in distinct terms that there are many who are convinced of the advantages of deep draining (I admit myself to be one) who, when dealing with the poorer and denser clays, yield to the views of the late Sir Robert Peel, when he said that he could conceive a case in which if the amount to be expended was limited, *increased closeness might compensate for diminished depth.* Deep drainers do not admit this compromise, however, because "the surface water cannot get down;" they do so with the candid acknowledgment that they do not like what they are doing, but that inasmuch as the draining of these soils must be as close at one depth as at another, they concede 6 inches in depth, in order to reduce the amount of interest a tenant will be called upon to pay to cover the outlay.

In determining the distance between drains, it is necessary not only to have regard to the nature of the soil, but to the amount of annual rain-fall and the frequency of rain.

A practical knowledge of the different clays of the different formations enables the draining engineer to determine pretty accurately the draining properties of each.

To enable a landowner whose experience is comparatively limited to form a judgment on the subject, I may venture to recommend a means of mechanical analysis which I have found useful, and which I explained last year. (See Land Drainage and Drainage Systems, page 28.) The proportions of sand and clay are ascertained by washing a given quantity in a flat-bottomed medical phial. The sand subsides below the clay and is visible through the glass. The existence of lime is ascertained by means of acid. If it effervesces lime exists, and if the lump dissolves very rapidly, there will be a considerable proportion of lime in the soil. The capabilities of the soil to expand and contract, are ascertained by weighing and measuring a given quantity at different times and under their different conditions of wetness and dryness. In cases of difficulty, recourse should be had to the chemist.

The necessity of a careful examination into the draining properties of clays, will be seen by a statement of the comparative cost of draining at different widths. A single yard too near may be a pound per acre thrown away, while a yard too wide may occasion dissatisfaction for ever. Taking labour at 7d. per rod, and pipes and haulage at 22s. 6d. per 1,000, the cost will be as follows:—

	£	s.	d.
At 18 feet apart	7	18	4
21 ,,	6	16	3
24 ,,	5	19	8
27 ,,	5	6	9
30 ,,	4	16	5
40 ,,	3	12	1

Experience shows that a consideration of the amount of rain-fall is a matter of much moment in determining the width between drains. It does not appear, practically, to govern the size of the pipes to be used, for if the ends of the pipes can be made to join securely, and the fall is good, the smallest sized pipes will be sufficiently large. But in proportion to the rain-fall, all other considerations being equal, should be the distance of the drains apart, in order that the soil may be sufficiently free at all times to absorb and discharge the maximum amount that can fall on its surface.

We find from sundry careful records, that 141 inches may be taken as the average annual rain-fall of the wettest place in Cumberland, while 19½ inches may be taken as the average fall in Essex.

It is not enough to ascertain the quantity of rain that falls, we should know the prevalent periods of continuance of rain and moisture, for in accordance with the length of time intervening between rains will be the opportunity for soils to undergo those changes of condition which are essential to complete development of draining, and which conduce to an improved "climate of the soil itself."

We find that the average number of days in the year in which rain falls in the wettest districts of Cumberland is 210, and at Castle Hill, in Devonshire, 191 days, while at Chiswick, the average number of wet days in the year is 124, with an average fall of 24 inches.

Fortunately, however, the clay soils of the west and north-west of England are comparatively open and porous, and thus counteract the humidity of atmosphere under which they exist, whereas the denser clays, lying to the east of the lias out-crop, have the advantage of a greatly reduced rain-fall, although the number of days on which rain falls is not proportionately less.

With respect to the direction of drains, I believe very little difference of opinion exists. All the most successful drainers concur in the line of steepest descent as essential to effective and economical drainage. Certain exceptions are recognised in the West of England, but, I believe, it will be found, as practice extends in that quarter, that the exceptions have been allowed in error. There is much difference of opinion as to the adoption of an equi-distant parallel system in lands of the ridge and furrow form. In arable land, the most successful drainers throughout the country disregard the furrows, whereas, we find the majority of those in the Midland Counties leaning to the adoption of the furrows as the course of the drains in grass lands. The same difference of opinion prevails as to the use of collars. Some good drainers object to them on account of the cavity left between the collars, but the majority approve of them, and would use them in all soils were it not for the additional cost. In sandy and gravelly soils they are indispensable. With regard to the admission of air to the heads of drains, as advocated by Mr. Simon Hutchinson, very few think it advisable, while some go so far as to say it is decidedly injurious.

Upon the question of outlets there appears to be much difference of practice where there should be none. In the whole process of draining there is nothing so desirable as permanent and substantial work at the point of discharge, so as to reduce to a minimum the ill effects of inattention on the part of tenants, and the neglect of communication between present and succeeding owners. It is considered that the more frequent the outlets the more active the drainage, but as every additional outlet involves additional cost in erecting and care in preserving them, prudence suggests that the number of acres draining to one outlet should never be more than 20 or less than six, if the form of the land and size of the fields will permit of these limits. On this arrangement, iron pipes, with swing gratings, set in masonry, may be provided at the cost of 1s. per acre. The outlets should be numbered consecutively.

If these several objects be borne in mind in carrying into operation the main principle of *adequate depth*, there will be but little chance of failure. Having perfected the work, one thing still remains to be done. A plan or record of the lands drained, and the position of the drains is necessary; and in order that such a record may be preserved for future generations, it is desirable that a national office, connected with the Tithe and Inclosure Commissions, should be set apart for the purpose. It would be invidious to point out instances in which recent works of drainage have already become useless from change of ownership and the indifference of successors. The cost of planning the drains after execution need not exceed 6d. to 9d. per acre, where a map of the lands already exists, and after we have spent £5 per acre in draining, does it not appear the very height of folly not to preserve a record of so expensive an object at a cost of 6d. per acre.

I cannot leave my subject without congratulating the country generally on a few points of great moment connected with it. First, is the improvement observable in field labourers from their occasional employment in systematic drainage. This improvement is to be particularly noticed in those counties where the wages were lowest and the labourers were esteemed to be inferior. I will instance the counties of Southampton, Wilts, and Dorset. When the General Land Drainage Company first commenced works in those counties, the use of the spade and graft appeared un-familiar to the farm labourers. We introduced labourers at nearly double wages from Northumberland and Yorkshire, to teach them their use, and we obtained more profitable labour from the Northumberland man at 18s. per week, than from the Dorset man at 10s. But the tables are now turned; we have at this moment Dorsetshire men employed at Swine, in Yorkshire, who surpass the Yorkshiremen in the quality and expedition of their work. And as it is known that a good drainer is necessarily a good hedger and ditcher, and a handy man at nearly all field work, we may consider that one good result from a general extension of draining will be to increase the capabilities of the farm labourer, and give him a just claim to better wages.

The next subject of congratulation is the increased healthiness of those districts in which any considerable extent of land has been drained;

And the last is the admission, now becoming very general, that the time has arrived when the main and tributary outfalls throughout the county must receive attention. The whole question is growing daily more and more serious, and I earnestly commend it to the consideration of those who, having influence, are willing to exert it in favour of an object of the highest national importance.

⁂ Since Mr. Denton's paper was written and in type, he has made the following addition to it:—

I must here refer to some observations made by Mr. Baker, last night, at the Central Farmers' Club, and I do so because it was evident that his words, uttered with all the effect of his high standing as an agriculturist, seemed to strengthen prejudices which are based on error.

He stated that it was impossible that drainage works could be permanent, and instanced a particular case of pipes being silted up though laid three and a half feet deep. Upon my asking him what they filled up with, he told me sand; and, on my asking if the pipes were laid with collars, he said "No."

Now, I need only remark that the whole question of permanency depends on the mode of execution. If gravelly and sandy land is drained only 3 feet 6 inches deep, it is hardly necessary to say that the drainage may be as deficient of depth as 18-inch drains are known to be in clays; and to drain any gravelly and sandy soil without collars, is simply throwing money away. If such works as these afford Mr. Baker the data upon which he declares it is impossible to render drainage works permanent, I can readily concede the fact.

Again, Mr. Baker referred to some works executed by means of the Government loan, and repeating the fact (in which I can corroborate him) that lands of different character have, in certain instances, been drained alike—he was pleased to attribute this to the influence of scientific drainers. Now, what is the fact of the case? The works that have been so executed under the commission, are those which landowners entrust to their own bailiffs, under the *nominal* instructions of the Government Inspectors, who really have no more to do with the actual execution of the works than men can have who are only called in at the commencement and finish. But on this point I hope there are some here who will speak and disabuse the public mind of the fallacy of holding public officers responsible for work requiring such particularity of management as drainage, who, perhaps, may not see it during the whole time of execution.

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DISCUSSION.

The Chairman was extremely happy in being the medium of conveying the invitation of the Society to those gentlemen present who would kindly favour them with their opinions upon the interesting topic before them; but in doing so he would make the remark, that as their time was extremely limited, and as the different branches and views of the subject were, he expected, numerous, it would be most interesting to learn the experience of as many as possible, and this would be best carried out by gentlemen making their remarks in a condensed form. The subject was not a new one, and the views of each speaker would be rapidly gathered if that plan were adopted.

Mr. Joshua Trimmer said, the remarks which he should make would be confined to the case of drainage upon the Keythorpe system, the principles on which it was founded, and the success which had attended it; and he should endeavour to reply to the objections raised against it, not only by Mr. Denton, but by others, on various occasions. The distinguishing character of that system of draining was, that it took advantage of certain subterranean furrows between the soil and the subsoil. He had for many years pointed them out to geologists as having important bearings upon the changes which the earth's surface has undergone, and to agriculturists with a view to drainage purposes. The last time he had brought them under notice in respect to draining, was in a lecture before the Royal Agricultural Society, on which occasion he pointed out for examination a section of a railway cutting, showing the irregularities which existed in the junction of the soil and subsoil. Those irregularities were the sections of certain channels between the soil and subsoil, of which the Keythorpe system of drainage took advantage, by laying the drains to intersect them. He could not better illustrate these natural furrows, or channels, than by supposing the artificial ridges and furrows made by the plough in Leicestershire and other clay districts, to be covered to the depth of three or four feet with a surface soil more permeable by water than the subsoil on which it rested. Rain sinking through the soil would collect in the furrow, and if there were any declivity in the channel, it would follow the line of the descent. The Keythorpe drainer cuts his drain across this diagonally, so as to preserve a sufficient fall in the channel. If it were asked how he finds out these channels, he would say that the drainer must dig numerous trial holes to find the point at which water enters, the height to which it rises, and the relative height which it maintains with respect to the holes above it. He then puts a drain in at the greatest distance from his upper hole that he has ever known to free it from water, and if that does not succeed, he puts in another, and sometimes a third. Those were the principles upon which he proceeded. He (Mr. Trimmer) then came to the advantages, which might be summed up in a few words. They were thus enabled to effect the draining of a certain area with fewer drains than by the system of parallel drains at equal distances. A saving of from 30 to 50 per cent. was effected on the cost of drains over intervals of 8 or 10 yards. The Keythorpe drainage had been sufficiently tested on the occasion of the ploughing match on Lord Berners's estate, on the 1st of November last. There had been 48 hours of incessant rain,—indeed, it rained so heavily that it was feared the match would have to be put off. However, it cleared up towards morning, and the match took place in the presence of gentlemen who represented every possible system of drainage, though he was not aware whether a certain Welsh farmer was present, who, when advised to drain his land, said, "it was not intended to be drained, otherwise it would have been made dry by Providence." All those gentlemen were perfectly satisfied with the state of the drainage of the farm on which the match took place. He came now to the objections which had been urged against the system,—the first being that the land could not be sufficiently drained. He would not go into that question, but refer to those who were present here, and had seen it. The next objection was, that if it was drained, the description of the soil, subsoil, and substrata which he had given could not be correct, because it was impossible it could be drained in the manner stated. He had, however, put the facts on record in the *Journal of the Royal Agricultural Society*, and should be happy to meet any objections urged against them in print. The third objection was as to the price,—it being stated that 30s. per acre for the labour of draining land was preposterously low. Lord Berners had a map on which, besides the areas of the fields, were laid down the distance and the depth of the drains, and the amount paid for the labour in draining each field. When he was drawing up the statement as to the cost, he took the average of nearly 400 acres, supplied to him by Lord Berners from the map. Lord Berners had also been examined before a Committee of the House of Lords on the improvement of land, when he put in a portion of this map as evidence, which gave an average for more than 100 acres, closely agreeing with the preceding statements. The result of these collective averages was only a few pence over 30s. Another objection was that there were a certain number of drains only two feet deep; the answer was, that those were made in the old furrows between the old ridges. Immediately the draining was finished these were ploughed down, so that there were now no drains on the farm less than three feet deep.

The Chairman—There are a few at 18 inches on the map.

Mr. Trimmer said Lord Berners was present, and would explain the reason of that. It was a mixed system of draining. The next objection was, that professional men could not give their services in such a system of drainage, as they could not be expected to devote their time to probing the soil, to find these subterranean channels; but he (Mr. Trimmer) was satisfied there would be a class of men spring up who would willingly drain land on the cheap system, on the same terms as others drained it on the dear system. The last objection was as to the length of time Lord Berners had been occupied in draining his estate. It was said that it was bad policy to occupy nine years in the draining of an estate, and that it would have been better to have applied to some of the draining companies and borrowed the money, if necessary, in order to drain it out of hand, paying a terminable rent charge in liquidation of the principal and interest. The tenant, not the landlord, it was said, paid for it, and the sooner the work was done the sooner would the landlord be in a position to avail himself of the improvement in an increased rent. That was a question on which landowners must judge for themselves, whether it was better to drain gradually and cheaply with their own money, or to drain at a dearer rate with borrowed money. He had thus gone over all the heads he proposed in the outset. Mr. Denton had told them the extent of land requiring to be drained. They had much of what was called practical draining going on, which was in most cases little better than a burying of pipes—they had much scientific draining which whatever its merits, involved a great burying of money. The Keythorpe system was founded on both science and practice, the generalisations of the former were confirmed by the operations of the latter. It was a system, therefore, well worthy the consideration of landlords who had estates requiring to be drained, and of tenants who it seemed were to pay expensive draining—

it was well worthy the consideration of draining companies, draining engineers, and drainage inspectors; and though last, not least, well worthy the attention of the Inclosure Commissioners, to whom was confided the power of deciding how entailed estates should be drained, if the cost of it was to be charged on the inheritance.

The CHAIRMAN read a list of the depths of the drains on Lord Berners' estate, from which it appeared that they were of the respective depths of 18 inches, 2 feet, 3, 4, and 7 feet.

Mr. HEWITT DAVIS stated, that he had anticipated that the discussion of the evening would have led to a further explanation of the advantages of draining to agriculture, and he had, therefore, prepared himself to have called attention to the advantages to the general health of the surrounding district by a properly conducted system of drainage. He confessed that he expected to have heard more about the principles of draining, and less of the details of particular practice. He had heard the observations of Mr. Bailey Denton with pleasure, but could not say he agreed with him in some of them—for instance, he did not believe there was any economy in shallow draining, for if the depth be diminished, so also must the distance between the drains, and in practice it would be found that the additional quantity of cutting and the extra number of pipes so required, would be more than equivalent to the saving of price in the cutting. Also with regard to the extra closeness of the drains in districts where the fall of rain was greater, he could see a reason for increasing the diameter of the pipes, because they would have more water to discharge; but if the land between the drains were made porous, the quantity of rain that fell could not affect the drains in any other way. With respect to what Mr. Trimmer had said, in his experience he had never found land lying with sub-ridge and furrow to admit of the practice that gentleman had advocated. It must be apparent that to hit these furrows the subsoil must lodge at a regular depth, and the furrows at a regular distance, and that the drains must be cut exactly across the fall, so as to receive the water, and to hold it till its discharge, but where was land to be found in this state? How were the conditions to be discovered, and how were drains to be made to intercept the current? Drain pipes afforded the same facility for water to soak away on the lower side as to enter on the upper, and for this reason would never intercept when placed across the fall. He had prepared a few remarks upon drainage, with respect to the general interest to the public, but as the evening was getting late he would reserve them for another opportunity.

Mr. MECHI considered that we had all seen reason somewhat to modify our views on drainage. It was quite clear that we could not apply one rule to all soils. The hills of Devonshire and Leicestershire, with a frequent out-cropping of springs from silty veins, required a different treatment from the level homogeneous soils of the flat, stiff, clay districts. On a recent visit to Lord Berners, at Keythorpe, near Leicester, he had been much gratified by the complete and economic drainage effected there. His lordship opened a number of deep holes, or graves, in various directions, and thus ascertained the level of the water and direction of the sandy veins intersecting the clay. By carrying a deep drain to one hole, many other distant ones were occasionally laid dry, whilst it sometimes happened that others close at hand required to be immediately connected with the drain. He had, himself, originally commenced with the system of the late Mr. Smith, of Deanston, but had abandoned it for the deeper system of Mr. Josiah Parkes, to whom they were much indebted. Drains could never be too deep in the strongest soils, but we might err in too wide a distance between the drains. He had drained 24, 30, 40, and 50 feet wide, and 5 feet deep, in very strong clays. In all these instances the operation paid, but those drains at the least intervals were the most profitable. Irrigating, as he did, with showers of liquified manure, he had frequently caused the drains (at 5 feet deep in strong clays) to discharge the coloured liquid—and it must be borne in mind that every foot of earth gained and amended in depth, was 1,200 tons of extra soil per acre given to the roots of plants. In his neighbourhood, where a crop of parsnips were growing on the edge of a clay-pit, the roots were observed to descend 13 feet 6 inches—in fact, the whole depth to which this pit had once been filled up.

Lord BERNERS observed, that he felt he owed an apology to the meeting for being so late in his attendance, but as he was obliged to be present at the Smithfield Club Dinner, he hoped that circumstance would be accepted as an excuse. He begged to return his sincere thanks to the Council of the Society for their invitation. He was the last person in the community who would wish to put himself forward, or to enter into any public controversy, but he was always ready to impart any knowledge he might possess on this interesting subject. His system was the result of many years' experience. He had tried, during a period of thirty years, on his farms in Norfolk, Suffolk, and Leicester, the most approved methods of drainage then in vogue, and he had expended several thousand pounds without arriving at any successful result. When it came to be discussed at the Royal Agricultural Society, and when draining assumed more of a science, he took every opportunity of having conversations with gentlemen who were of the greatest note at that time in reference to draining, Mr. Josiah Parkes, Mr. Smith, of Deanston, Mr. Hewitt Davis, who was present, and many gentlemen at the Agricultural Society. It was then laid down by scientific men, that a certain system was best to be adopted, namely, a drain of a certain depth, one saying 3½ feet, another 4 feet, and so on—and that these drains were all to be carried down to the greatest declivity. He stated at a meeting of the Royal Agricultural Society, that he considered it to be presumption for any person to say he could lay down a rule or system of draining for any farm, much less for any district, for in his practice he had found that he could not lay down a system of draining for any single field. It was recommended to him very strongly that he should drain down the greatest declivity in clays such as those he held in his hand. He sent a specimen of the clay to a gentleman who was considered to be the greatest authority in the Royal Agricultural Society at that time, from whom he received a letter stating that it was very true that the quality of the clay he had sent was of a most impracticable character, but that if he persevered there was no doubt that the plan would answer as well as it had answered at Pusey. He accordingly tried the various schemes side by side, though with an impression on his own mind that they would not answer. He watched with anxiety for the result, and found that none of them succeeded. He then cut a diagonal drain across, and freed the whole of that table land. He claimed to himself no merit of originality or novelty, or anything but that judgment which every man could exercise in the case of his own farm, by ascertaining whether the system recommended was applicable to it or not. He did not wish to assume that his plan was the best; but he asked every farmer, and every one interested in draining, to go and see his farm, and he would show them 2,000 acres in Leicestershire, effectually drained, at a cost of £1 or £2 per acre. In Suffolk and Norfolk also, in a ten-acre field, he had more effectually drained it by an additional outlay of £1 to £2 per acre, than by a previous outlay of £10, £15, or £20. He would give them an instance:—He had a very strong retentive clay farm in Norfolk, where he had a very intelligent bailiff, who had been draining under the old system, which he (Lord Berners) did not approve. If he had known then what he knew now, it would have saved him some thousands. He told the bailiff that he was not deep enough, and not draining in the right direction, and he gave him instructions to dig some holes at the end of the field. In about three months afterwards, the man came to him and said that if he would come he would find that the driest part of the field. At the depth of 3½ and 4 feet they came to little fissures or pipes of sand, like a tobacco pipe, though there was no sand within a mile of the place. Mr. Hewitt Davis had remarked that the under strata ought to be known before they commenced draining, but that there would be some difficulty in carrying out this practice. There would be no difficulty in carrying out the Keythorpe system—any man of common observation would in a moment tell how to do it. He would first speak of grass land. The object of course in all draining was not only to take away the surface water, but to take away what was sometimes called the deep water, or spring water. He held in his hand a sketch which he had made after receiving the invitation from the Council of the Society, and he also felt it his duty to bring samples of the clay, which were there for the inspection of the meeting. In Leicestershire there were ridges and furrows of various widths, from 4 to 11 yards long, and varying in height from 1 to 2 feet, and some 3 feet. He mentioned this, as Mr. Trimmer might, when speaking of ridges and furrows, have alluded to the under strata, while he (Lord Berners) alluded to the upper strata. He had laid down a drain in one field in Leicestershire, and after it had been done seven months, the pipe became filled with a hard substance that prevented the water from flowing.

Mr. MECHI—It entered the drain in solution, I suppose.

Lord BERNERS said, that such must have been the fact. The drain was laid down in a strong stiff clay, near the Conservatory, opposite the drawing-room window, and the result was as he had stated. He had expended several thousands of pounds in trying shallow draining, but his experiments had resulted in failure. In Leicestershire it was said that the proper way to drain was to follow the furrows, but on experience he did not find that system answer. He then tried cross-drains, but he was persuaded that the true principle was to take the water from the bottom. If you wanted to empty a cup of water without upsetting it, the proper way would be, not to pierce holes high up in the sides of the vessel, but to make a little hole at once in the bottom, which could not fail to effect the object in view. He had also made experiments with heavy retentive clays, and he had found that if the drains were put as close as they well could be, the water could not percolate. He had tried drains so placed after seven months, eleven months, and two years, and the water had never run out of them. Finding there was no use in draining in that direction, he cut cross-ways wherever he found any porous substance, and then the experiment was successful. In this way he had drained a field of 70 acres, in Norfolk, by a single drain. On one of his farms in Leicestershire, which he had taken into his own occupation at Michaelmas, he found the land so wet and heavy that it could not be crossed by man or horse during the winter, and he found on inspection, that in the intermediate space there were many pounds worth of tiles which the tenant had put into the strong clay, but which were quite worthless; two feet of water standing in the trial holes, below the pan and the upper surface, wet and undrained.

The CHAIRMAN—What was the depth of the tenant's drainage?

Lord BERNERS—From 22 to 26 inches.

Mr. MECHI.—They became what are termed "puddle ponds," did they not?

Lord BERNERS.—If drains were put into this description of clay, the water never could percolate through it. He did not assume to himself any credit for originality in the system of drainage he had carried out, and he would put the sections he had made into the hands of the Chairman, who was perfectly welcome to make what use he pleased of them. There was one point more which he wished to mention, and that was the advisability of keeping a record of the exact places where the drains were put down, and also the situation of the out-falls. In his office an account was kept of each drain, showing its direction, but the small drains were only regarded as adjuncts to the others. If any gentleman present would come to Keythorpe, not for a couple of hours, for that was no use, but for a day or so, he would give him a welcome, and would show him over the land, and he (Lord Berners) believed he would find a triumph of draining not to be met with in any other district. By the use of trial holes they would find not only the proper depth it was necessary to lay the drains in each field, but when those holes were emptied by distant drains, they would see nearer ones were not necessary, and thus the saving of expense effected by the union of porous spots in whatever direction they might occur.

Col. CHALLONER was in hopes that we should have had a little practical information from Mr. Denton, in the course of his paper, upon the method of laying the pipe tiles in drains, because he believed that many of the failures in draining were owing to the imperfect manner in which the pipes were so often laid by the workmen. The great fault was, that they laid in their drains without sufficient attention to the *amount of fall* which they had to dispose of; and very often consumed three-fourths of the fall before they had got half-way to the upper point to which the drain was to be carried. To avoid this, he recommended the use of a common bricklayer's level, with a hinge at one end and a means of fixing it at the other, by which the exact *proportion* of fall might be obtained, and thus the drain be laid in one uniform line from top to bottom. By this means depressions or dips in the drains would be avoided, and the accumulation of sand in the pipes, which was one great cause of failure, would be prevented.

Mr. J. W. BAZALGETTE, the engineer to the Metropolitan Commission of Sewers, stated that he had not come prepared to speak upon the subject, but he should regret to find the discussion resolve itself into an advocacy of either deep or shallow drainage. Undoubtedly the advocates of both systems were to a certain extent right, and it would be impossible to fix upon any depth which could be suitable for all kinds of soil. He (Mr. Bazalgette) agreed with those gentlemen who considered that the natural features of each locality should first be carefully examined, and the drainage works afterwards designed to meet the peculiar requirements of each case. There were a large number of gentlemen present from various parts of the country, each of whom could contribute valuable results, which, when collected, might throw considerable light upon the science of land drainage. It appeared to him that in considering the subject, the first principles to be determined were—First, what is the minimum depth to which the waters should be reduced below the surface, to render the drainage perfect. It might vary considerably in different localities, and for different purposes, and this was a question for the agriculturist to determine. It was then for the land draining engineer to ascertain at what slope the waters would percolate through various soils with sufficient velocity from this minimum depth below the surface towards his drains; and the relative distance between them and the required depth of the drains themselves would then be resolved into a question of comparative cost, and could be determined upon a sure and safe guiding principle. There were still various other most important questions, such as the sizes of pipes, the necessary inclinations for them, and the best mode of laying them, into the consideration of which he would not at that late period of the evening attempt to enter.

Mr. H. S. THOMPSON had no new principle to introduce, and merely rose to offer an explanation of a singular fact, which had frequently been noticed, but, he believed, had never yet been accounted for. It was known that in certain cases deep drains began to run, after rain, sooner than shallow ones, which fact had been long disputed, and when proved beyond a doubt had puzzled the highest authorities in such matters. He had been present at discussions at which Mr. Parkes and others had offered suggestions to account for it, which were not satisfactory to him. He had, therefore, had glass tubes made, of different lengths, and filled with soil, and had tested the times at which they began to drip when water was poured on them all at the same moment. If the soil was dry, the short tubes, which represented shallow drains, began to run first, but if water was again poured on the tubes before that previously poured on had all passed through, they began to drip again immediately that the second quantity of water was poured on, and without waiting for the water last used to pass through the soil. This was evidently due to the elasticity of the air confined between the free water at the bottom and that at the top of the column of earth, and in this case all the tubes, of whatever length, began to drip at the same moment. If, however, the tubes, after the first application of water, were allowed to remain some weeks, the short tubes discharged the whole of the free water, but the long ones, representing deep-drained land, still retained a little free water at the bottom of the column of earth, and when water was again poured on at the top, this free water was *immediately* discharged, or the deep drain began to run; whereas the short tube, or shallow drain, having discharged all its free water, did not begin to drip for some time,—in fact, not till the water had percolated through the column of soil. He had repeated the experiment in various ways, and always with the same results. This was a small matter, but a fact, however trifling, if rightly explained, sometimes elucidated a great principle, and in this case, by tracing the course of the free water in its passage through long and short columns of soil, he had derived great instruction as to the action of deep and shallow drains, and satisfied himself that there was no fear of making land too dry by deep draining, except in peat soils. The lateness of the hour, however, would not admit of his entering further into the subject on this occasion.

Mr. ROBERT BAKER (of Writtle, Essex) stated that at the late hour at which they had arrived he would not trouble the members with any lengthy discussion; but as Mr. Bailey Denton had made observations upon him in his opening paper, the purport of which he could not clearly understand, he felt called upon not to let them pass entirely unnoticed. He however thought that the discussion was not carried out as put down upon the card, as to the results of draining. The discussion, on the contrary, went to the practical portion of draining, according as each speaker had considered to be most desirable. As for himself, he had little to offer, but he considered that one principle, in a geological point of view, was applicable to every soil—the relieving it of the superabundance of water it might contain; and as the water was held by the porous portion of a subsoil, he did not see the necessity of penetrating the retentive subsoil below to any greater depth than was sufficient to enable the water to collect in the drain below, and thus to be carried to the out-fall and discharged; and then, he submitted, that any fixed depth of four feet or more prescribed for the drains would be totally unnecessary, further than as concerned their durability, and relieving the soil of water to the depth of two feet. It ought to be recollected that, except in cases where the strata had become disrupted suddenly, that the dispositions of the substrata were constantly alternating from a porous to a retentive one, and that in almost every case where a porous strata was found, it would be found resting upon one of an impervious or retentive character, and this invariably occurred, so that throughout the whole disposition of nature, exhibited over large districts, the same law prevailed. Take, for instance, the district upon which his own farms were situated in Essex,—the upper surface strata consisted of beds of gravel sand, loams of every degree of tenacity resting upon the tenacious London clay, which in many instances rose to the surface abruptly. This clay was found resting upon chalk, prevailing at the north-west portion of the county, the chalk also resting upon the tenacious gault clay, that resting upon the green sand, and that, in its turn, resting upon a tenacious clay. Thus the provision of nature was fulfilled of supplying spring-water at every point where these various descriptions of strata approached the surface; and he begged to call the attention of drainers to this particular, as essentially necessary to the development of the science. As regarded what had been stated respecting the Keythorpe estate, he was willing and pleased to corroborate all that Mr. Trimmer and Lord Berners had stated upon it, for when he visited the spot in the early portion of last month, it had been raining almost incessantly for nearly 60 hours previously, and when almost every field had become more or less submerged in water, not a drop was observed stagnating upon the drained portions of his lordship's estate. And to such an extent did this prevail, that in a field upwards of 20 ploughs were in motion for a ploughing-match, without being in the slightest degree incommoded by any superabundance of water; whilst in the adjoining field, that had not been drained, within 100 yards, a draining match was exhibited, and such was the quantity of water discharged by the drains as they became opened, that the drainers were unable to proceed with the work, by reason of the large quantity that followed them during the operation; thus exhibiting by contrast one of the greatest triumphs of draining, and showing how mind had been brought successfully to bear upon matter in an astonishing manner. He would not longer trespass upon them, although he could have desired to have said much more upon the subject. He regretted, however, the diversity of opinion that existed between agriculturists, not only upon this but upon other subjects, for it would be generally found, that if ten of them offered an opinion upon subjects of the most ordinary nature, that all of them would differ.

The Rev. J. C. CLUTTERBUCK wished to say a few words with reference to the observations made by Mr. Trimmer on the peculiar geological condition of the subterranean surface of clays, with reference to which the Keythorpe system of drainage had been carried out. Referring to a section of a ditch cut into the gault clay, the clay rose in waves, or in ridge and furrow, to within about two feet of the surface, the indentations or furrows being filled with drift, and the whole covered with the cultivated soil. Mr. Clutterbuck had observed this condition of subsoil not only in the gault, but in the kimmeridge and Oxford clays, and it no doubt was the same in the lias at Keythorpe. So far as his observation went, these furrows ran at right angles to the dip of the strata, and had no reference to the inclination of the soil, which might or might not be in the same direction as the geological dip of the stratum, but that in a great measure depended on the depth of the drift overlying the substratum of clay. Draining land where this condition of subsoil existed, must depend more on the direction of the drains than on their depth. A drain cut transversely through the subterraneous furrows would drain the land by allowing the water in the drift to escape, whereas drains cut along the line of these furrows would not draw the water which was impounded in the next furrow, though at a distance of only a few feet. A remarkable instance of the effect of cutting through one of these subterranean ridges occurred in making a drain at Oxford, known as the Jericho drain. This drain was cut through the Oxford drift into the Oxford clay beneath; by the section made at the time, it appeared that the drain did not cut across the subterranean ridges up to a certain point, but at that whence it took another direction. Two of these ridges were cut through, and the consequence was, that the wells in that part of Oxford were wholly, or in part, deprived of their water. Had the drain been cut longitudinally to these ridges, the probability was that the effect would not have been the same, and it was mainly to the loss of the water from those wells that might be attributed the successful opposition offered by many of the inhabitants of Oxford to the plan of drainage proposed by Sir W. Cubitt, assisted by Mr. Macdougal Smith. Any one might easily be convinced of the existence of this condition of surface in these clays, and wherever it did exist, no depth of drain would be efficient except their direction be studied. Trial holes, as described by Lord Berners, or trenches cut in various directions, would enable the drainer to ascertain the existence and directions of these ridges and furrows, and all drainage, to be effective, must have reference to the condition of the subterranean surface of the clay; by this the direction of the drains must be ruled, otherwise large sums might be expended to no effect. This geological condition seemed to be referable to a recent geological period, that was long after the deposition of the strata in which it was found to exist. When the clays were covered with the stratum "in situ," that was, for instance, where the kimmeridge clay was covered with the superincumbent green sand, these ridges were not seen, but where the clay was only covered by drift, then the wave or ridge and furrowed condition was easily traced.

The CHAIRMAN said that, as the hour for adjournment was passed, the discussion must now be brought to a close. At the same time, he hoped that another opportunity would be afforded for resuming the discussion, as it was impossible in so limited a time to do even moderate justice to so important and varied a subject. It would be presumptuous in him to make any remarks on the theme submitted for discussion that night; at the same time he would be glad to offer a few observations, in order to arrange the matter which had been set before the meeting, and to state his own views, as a conclusion of the debate. In discussing a subject of this nature, they must all remember that they were but learners. They could not lay down a rule, but they might lay down a principle; and, he thought, he was justified in saying that a certain principle had been established. It might be considered as established that under-draining a wet soil gave a rapid descent to the water, and secured the dryness of the subsoil. No one, he thought, would deny that although shallow drainage might answer locally, the operation of deep drains had been uniformly successful; and that, although shallow drains were often taken up, there was no instance of deep ones being disturbed. No doubt there were peculiar geological formations that enabled the drainer to accomplish his object at a less expense. His own experience led him to suppose that a drain of from 3 to 4 feet in depth, at intervals of between 6 and 10 yards, came, as nearly as possible within what might be laid down as the best principle. The ancients appeared to have had no defined plans of drainage, as their climate was not so moist as ours, and, therefore, no light was to be gathered from them; but, having seen so many different depths tried, on the whole his own experience was so conflicting that he could not venture to lay down any rule; at the same time he had seen surprising results follow from the difference in depth between 3 and 4 feet. He thought that the Keythorpe system was one in which the science of geology was made to assist the labours of the drainer, and that a great reduction of expense was effected by its application.

Lord BERNERS said, with respect to depth, one of the great advantages of trial-holes was, that the proper depth could be ascertained. First of all you must dig to such a depth as that the water will come in freely; a little deeper, then, to see whether the water would accumulate fast, and by that means, if you come to anything like a porous soil, it was deep enough.

Mr. ACLAND stated, as one more fact bearing on the question of the direction of drains, that in Devonshire it was found to be of great importance to lay the drains across the lines of stratification, which generally run from east to west.

The CHAIRMAN trusted the subject would be taken up on another evening, and that as many would attend as possibly could. Although the subject of draining had been really, in some sense, exhausted, still the local peculiarities had to be attended to, and the question would bear much further discussion.

A vote of thanks was then unanimously passed to Mr. Denton for his paper.

Mr. DENTON thanked the meeting for the vote the Chairman had just communicated to him, and said that as he did not wish them to separate with an impression that he was an advocate of one universal system of draining for all soils, and under all circumstances, he must take that opportunity of repeating, that he only acknowledged *one* fixed rule, and that was the *principle of depth*.

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 19th instant, was "The Present Position of the Iron Industry of Great Britain, with reference to that of other Countries," by Mr. J. Kenyon Blackwell. On this evening Mr. Joseph Glynn, F.R.S., will preside.

⁂ It having been represented that there were still many gentlemen who were anxious to offer some remarks on the "Under-drainage of Land in Great Britain," the Secretary is authorized to state that an Extra-Ordinary Meeting has been fixed for *Friday*, the 21st inst., at 8 p.m. precisely, for the purpose of renewing the Discussion.

PARIS EXHIBITION, 1855.

THE PAPER MANUFACTURE.

Some of our members who have visited Paris during the past summer, having adopted the commendable course of giving their opinions through the medium of the *Journal*, upon subjects with which they are familiar, in following their example I venture to hope that a short memorandum on the Paper Manufacture, as it appeared in the Exhibition, may be acceptable to some of your readers.

MACHINES.—The most noticeable articles of this class were:—

1. The rag-engine, cast in one piece, and having a smal steam-engine attached. (M. Gratiot, Class 6, Sec. 10.)

For mills where paper is made from straw, and requiring but little steam-power, this combination, for compactness and economy, presents some points worthy of consideration. The motive power being close to the work to be done, no loss is incurred by gearing, and, although not adapted for all cases, might be advantageously employed in certain circumstances.

2. A pulp meter, on a simple principle. (Prussia, 252.) The machine appeared to be perfectly under the control of the workman, and large and small differences in the quantity of material used could be easily gauged.

3. Cutting machine for paper and millboards. (Paris, Poirier, Porte St. Martin.) Possesses great power and rapidity of action. The cut is diagonal, and by the judicious combination of a system of double levers and an eccentric, the table and knife both move, thus facilitating the operation; and no reverse motion is necessary to separate the knife from the table carrying the paper. Moreover the table and knife alternately close and separate, in whichever direction the handle may be turned.

MATERIALS.—Of these I noted the paper exhibited by:—1. Messrs. Coupier and Mellier (France, 2889), composed of 85 parts straw and 15 parts paper shavings.

The price at which dry pulp could be produced was stated to be 50f. the 100 kilogrammes, or about £1 per cwt. If the prospect thus held out can be realised to the extent of one-half, it offers great consolation to those who have been fearing the failure of paper materials.

2. The specimens of paper shown by Messrs. Louvié and Yelli, made of the *Mussa paradisaica* were very interesting, but the cost of production was not stated.

3. Some specimens of a new material, the name of which was not however given, exhibited by the Papeterie de Majoulassy, were remarkable chiefly for the apologetic manner in which they were submitted for inspection. I subjoin a translation of the peculiarly French announcement which accompanied them:—

"I am a new product, still in my infancy;
If I am not white, it is not that I come from Africa,
For I am French; I might be Spanish,
German, English, in fine wherever agriculture flourishes.
Who cultivates me will not lose his time;
Then I shall become a great source for the making of paper.
Without wishing to dethrone rags, I may be worthily their succedaneum.

P.S.—If I dare to present myself such as I am, it is that the Exposition is too soon, or that I have been discovered too late; there has not been time to make my toilet; all my substance is capable of being whitened."

Of ultramarine many specimens were exhibited, but as the quality of this article can only be properly tested in the working, it would be unfair to give an opinion. I only noticed one maker who affixed his price (Rohr, of Wiesbaden), from which it appeared that his best quality was deliverable on the banks of the Rhine at 100fr. the 50 kilos., or 8d. per lb., about half the price the best quality is sold for in this country.

PROCESSES AND RESULTS.—Several novelties were well deserving the attention of manufacturers.

1. Undoubtedly the most important exhibition in the whole of this Class was that of Messrs. Pirie and Sons, of Aberdeen, consisting of cartridges, bags, and bottle wrappers, made in one piece, by the paper machine out of pulp, without join or seam.

So important has this invention been deemed by the English Government, that special works are now in process of erection at Woolwich, for the manufacture of cartridges on this principle.

2. Messrs. Drewsen (Danish Monarchy, 85) exhibited some excellent specimens of papers *satined* in the web; and from the different surfaces of the papers the degree of glazing seems perfectly under control.

3. Mr. T. H. Saunders, of London, likewise exhibited some satined webs, and in addition to reams of paper of his own manufacture, his stand presented a collection of specimens, forming a complete epitome of the English paper manufacture, from bank-note and ornamental paper to the coarsest brown and packing papers, divided into five classes:—

1. Papers made by hand.
2. Papers made by machinery.
3. Special papers, including bank-note, parchment, loan, watermarked, and coloured papers.
4. Papers forming the raw materials of other manufactures, or requiring some further operation before use by consumers.
5. Packing and wrapping papers.

The specimens were bound in volumes, with suitable descriptive letter-press.

4. M. Firmin Didot's improvement in the mode of bleaching, of which a diagram of plans was exhibited, consists in the application of carbonic acid to facilitate the separation of chlorine from lime. Whether the bleaching material be applied in the engine or a chest, the carbonic acid is conducted into the apparatus, and, combining with the lime, releases the chlorine. From those who have witnessed experiments, it is understood that a considerable saving of time is effected by this process.

5. M. Gary (France, 2882) exhibited some excellent cigarette paper.

6. Hoesch and Fils, of Düren (Prussia, 409), exhibited a very good collection of coloured papers.

7. The Essones Company state that they make four tons of paper per day, and two million envelopes a month. They have four machines, and employ 350 workmen, for whom they provide lodging, garden, saloons, medicine, school, and hospital;—a very good example to our large English manufacturers.

Several other manufacturers exhibited, but as their articles were either inclosed and therefore inaccessible, or of trifling importance, I pass them over. I may, however, just allude to a bag-making machine, and a numbering apparatus of simple construction, both from the United States. I did not observe one of the elegant though rather complex numbering machines used in this country.

An ingenious contrivance for marking the level of liquids, and applicable in several branches of this manufacture in common with others, consisted in the use of a magnet floated in the interior of the vessel, and a small needle of iron outside. As the magnet rose or fell by the increase or diminution of the liquid, the height was indicated on the exterior by the small needle.

I may observe that although the Jury awards have been made since the preceding notes were penned, I do not find in those awards any reason to alter the opinions formed in the building itself; in fact, my view of the subject of awards, and the whole system of juries, founded upon the results of the Exhibition of 1851, has been more than confirmed by the working of the present Exposition.

It is almost impossible to obtain a competent and fair jury, for if the judges know nothing of the specialities of the articles submitted, it is unreasonable to suppose that the relative merits can be duly estimated; and if they are conversant with the points of eminence which each manufacture should aspire to possess, they have for the most part been connected with the manufacture, and it would be demanding of them to discard some portion of the constitution of their nature, to require that they should retain neither prejudice nor prepossession.

In addition to this serious difficulty, another presents itself, the working of which it is amusing to those not interested to observe. I refer to the circumstance that exhibitors have to pass through a second ordeal, in which the verdicts of the juries are ruthlessly set aside, frequently without their being consulted, sometimes even against their protest.

As one instance, your readers will recollect the great musical squabble between Messrs. Erard, Broadwood, and Collard, who, in 1851 were each recommended by the jury for the Council Medal; the judgment of the jury, selected for its competency, was set aside by gentlemen who never professed to understand the manufacture of musical instruments, and the Medal awarded to one firm, to the prejudice of the other two. Injustice brings its reward, the injury of 1851 caused the absence in 1855 of the productions of two establishments whose articles would have reflected honour on the country.

In this respect we cannot say they manage matters better in France, for Prince Napoleon states in the report to the Emperor, that *after* the majority of the jury had left Paris, the Council of Presidents took upon itself to reduce into the Silver Medal Class 200 *eminent manufacturers* who had been recommended for the gold medal.

The injustice of this proceeding cannot be sufficiently condemned, bringing juries and awards into disrepute, and leading one to hope that, should a Universal Exhibition be ever attempted again in this country or anywhere else, the whole system will be utterly rejected.

W. STONES.

Home Correspondence.

MR. F. WEBSTER ON THE ORATORY OF THE SENATE.

SIR,—If the Institutions in Union were generally to send you information respecting the incompetency of certain lecturers, much disappointment and vexation might be saved; and I feel it to be a matter of duty, as a warning to other Institutions, to make public at once, facts relative to a lecture just delivered here by Mr. F. Webster, of Weymouth-street. The committee of the Croydon Literary Institution, believing that the lecture on the "Oratory of the Senate," which Mr. Webster offers to deliver at Institutions, would be useful and acceptable to their members, engaged him for last night. He made his appearance accordingly, but his lecture gave general dissatisfaction, for an *extempore* and able address was expected from a professional elocutionist. At the commencement of the lecture, allusion was made to the mouth and organs of speech, when, to the surprise of all present, Mr. Webster intimated that he would pause a few moments, to introduce a friend of his, whom he alluded to as the son of Mr. So-and-so, of such-and-such a number and street (giving the full address with all distinctness), the *celebrated dentist*, who had invented and *patented* wonderful improvements in the construction of false palates, &c. The individual alluded to then stepped up on the platform, and commenced reading from the manuscript at the point where Mr. Webster had left off. He held in his hand a model, with a set of artificial teeth and palate, and explained the unrivalled manner in which such appliances were constructed at his establishment. I need hardly add that this exhibition offended all present. Upon being remonstrated with after the lecture, Mr. Webster endeavoured to make it appear that his friend explained matters which he himself was unacquainted with; but the attempted explanation is perfectly absurd, as the *whole thing was written from beginning to end*, and surely the dentist's part might have been *read* by Mr. Webster. The person who obtruded himself on the audience in so unseemly a manner is connected with a regular advertising concern in London. Trusting this *exposé* will save many an Institution the annoyance of being employed as a vehicle for puffing,

I remain, Sir,
Your most obedient servant,
SAMUEL LEE RYMER,
Honorary Secretary.

Croydon, Literary and Scientific Institution, Nov. 27th, 1855.

MR. HARRY SCRIVENOR'S PAPER ON THE IRON TRADE, AND THE DISCUSSION THEREON.

SIR,—As Mr. Harry Scrivenor refers in his valuable paper read last Session, to the account in his own volume of the astonishing results effected on the growth and the expansion of our iron trade, by Mr. Cort's inventions of puddling with the flame of coal, and subsequent conversion of the copious produce into bars by his grooved rollers, I perhaps ought not to complain that he considered it out of place to notice at more length the merits of a man who has truly been to Great Britain, what is designated in the words of Locke *the Father of Arts and author of plenty*. Previous to the invention of grooved rollers, rolling had only been applied to the manufacture of sheet iron, for tin plates, &c., and all small sizes of bars were obtained from larger hammered bars, subjected to the *slitting mill*, invented in Sweden, and which the indomitable ancestor of the present Lord Foley imported from that country, about the year 1740, by a series of adventures which form a great practical romance, and earned a fortune and a peerage. The very different reward which Cort received for his much greater services is certainly a painful reminiscence. and, therefore, probably out of place amidst the calculations of prosperity. But I beg to be permitted to offer a few words on Mr. Bird's remarks in reply to Mr. Scrivenor. I cannot say I fall into this gentleman's peculiar train of reasoning upon the fluctuations of the iron trade. Thus he attributes the rise in the price of iron which occured one year after the Great Exhibition in 1851, and five years after the panic depression of 1847, to the display, on that occasion, of our raw material, which induced foreigners to come and buy the iron which they perceived it could furnish. I cannot at all agree that these facts stand in the relation of cause and effect. The fluctuations of the iron trade have been constant at more or less regular intervals, and have been produced by far more important events than Mr. Bird appears to suppose. There were no foreign visits in 1845 to raise the price of bars from £4 10s. to £12 per ton. He is equally at fault in attributing the era of the existence of *cheap iron* to the invention of the hot blast. Hot blast was in full use in 1845-6-7, when iron ranged at £10 to £12 per ton, and he will find by reference, that at intervals, long prior to the use of the hot blast, iron was cheaper than it is now. The era of *cheap* iron dates as far back as the year 1785, when for the *first time* British iron was *made* of a quality fit for anchors and other first-rate uses, *tried* successfully at the Royal Dockyards, and reported on by that celebrated light of science, Dr. Black. This is the date of the era of *cheap* British iron at £10 per ton, substituting *Russian iron* at £35. That Mr. Bird may not remain under a mistake in so very important a matter, I beg to refer him to a cotemporary authority, too conclusive to be overlooked, who witnessed the progress of this amazing change, the Earl of Sheffield, who wrote the following passage in 1786:—"If Mr. Cort's very ingenious and meritorious improvements in making and working iron, and *his invention of rolling bar iron*, and the great improvements of the steam-engine by Watt and Boulton should all succeed, the expense may be reduced so greatly that British iron may be afforded *as cheap* as foreign, even if the latter should be allowed to enter duty free, *perhaps cheaper* and of as improved a quality, and in quantity equal to the demand, then it is not asserting too much to say that that event would be more advantageous to Great Britain than thirteen colonies; it would give the *complete command of the iron trade to this country*, with all its vast advantages to navigation."—*Observations on the Commerce of the United States.*

These remarks are prophetic, and they have been fully realised. I think no person conversant with our metallic industry should remain a moment in ignorance of so great a land-mark in its history.

I am, Sir,
Your obedient servant,
DAVID MUSHET.

December 10th, 1855.

Proceedings of Institutions.

ALTON.—The eighteenth annual report of the Mechanics' Institution states that a reading-room, which has lately been opened for day readers, has been much frequented. There are about 50 members, who pay an annual subscription of one guinea each, in order to avail themselves of the use of this room, which is open from 10 A.M. until 10 P.M. The quarterly subscribers, and those who pay annually less than a guinea, are admitted at 5 o'clock, instead of 7, as formerly. The lectures during the last winter were 11 in number, and were delivered by Mrs. Balfour, and Messrs. Macintosh, Wheeler, Grossmith, Moody, Ryde, Williams, Hughes and Ellis Roberts. It was announced that the Museum will be opened early in the ensuing year. The number of members is 89 annual and 114 quarterly; of the latter by far the larger proportion are mechanics, apprentices, and boys. The receipts during the year amounted to £108 0s. 5d.; the expenditure to £106 12s. 6d., but as there was a sum of £15 14s. 3d. due to the treasurer at the end of the previous year, there is still a deficit of £14 6s. 4d.

EPSOM AND EWELL.—The fourth annual report of the Literary and Scientific Institution congratulates the members on the continued support it receives. Of the existing members thirty-nine pay £1 1s., and twenty-one pay

10s. yearly; forty pay 2s. 6d., and eleven pay 1s. 6d. quarterly. The total revenue from subscriptions and donations during the past year amounted to £81 7s. The library has received considerable additions, but the Committee have refrained from expending the whole of the available resources, believing that they might be found valuable at a possible future period of depression. The balance in the hands of the Treasurer amounted at the close of the year to £71 6s. 9d. The number of issues was 658 volumes. Of these 162 were works of fiction; 130, general literature; 70, biography; 110, periodicals; 45, reviews; 45, books of travel; 18, history; and 18, poetry and the drama. During the year two concerts were given by the English Vocal Union, to which a small charge was made, and six lectures were delivered.

HACKNEY.—On Wednesday evening, November 29th, Mr. John Bennett, F.R.A.S., delivered an interesting lecture at the Literary and Scientific Institution, on "The Birth, Parentage, and Education of a Watch." The origin and history of watches were noticed with the progressive stages of improvements. The different parts of a watch were dwelt on and explained and exemplified by a great variety of specimens. The compensation-balance and pendulum clearly explained, and most interesting details given with respect to the manufacture of watches in Great Britain and Switzerland, showing that there was a greater subdivision of the work in the latter work, so that each individual was employed upon that part in which he or she might excel. The lecture was listened to with great attention, and was both interesting and instructive.

STALYBRIDGE.—On the 19th inst., J. D. P. Astley, Esq. (lord of the Manor of Dukenfield), who has lately returned from the Crimea, delivered a lecture at the Town Hall, to the members and friends of the Mechanics' Institution, "On the Siege of Sebastopol," in which he described, in a familiar manner, the operations of the siege, offensive and defensive, from the commencement, in 1854, to the fall of Sebastopol.

TENTERDEN.—A lecture, in connexion with the Mutual Improvement Society, was delivered in the Town-hall, on Wednesday evening, Nov. 21st, by the Rev. H. Solly, on "The Nature and Character of a Gentleman, Historically, Conventionally, and Rationally." The opinions of every grade in every phase of society on the subject were given, from the aristocracy to the apprentice boy. The influence exercised on society by the Christian gentleman was justly described, and the lecturer urged upon all in every rank and grade the necessity and importance of being Christian gentlemen, the essential elements of which consist in self-respect and respect for others.

WINCHESTER.—The Hants and Wilts Adult Education Society intend offering to all places having Institutions in union a gratuity of two pounds, in money or books, to the teacher who shall have conducted an evening class or classes during the current session, ending April 30th, 1856, to the satisfaction of such inspector or inspectors as they may appoint, subject to the following conditions and limitations:—

1. That the gratuity thus offered be doubled from local sources independent of the payments made by the persons attending the classes.
2. That no pupil be under the age of 15 years.
3. That the average number of the class shall not be less than two per cent. of the population of the town or village, nor in any case less than seven in number.
4. That the aggregate attendances of each person under instruction shall not be under 50, of two hours each, to be certified to the satisfaction of the inspector.
5. That reading, writing, and arithmetic be deemed essential subjects of instruction; but that geography, English history, and other branches of knowledge, will be favourably considered and reported on by the inspectors.
6. That the progress and condition of the classes meet the approbation of the inspector. The committee reserve to itself the power of withholding the gratuity on the ground of insufficient merit, or of marking its sense of higher efficiency by increasing it.

Another proposition issued by the committee relates to the union of libraries and interchange of books, viz:—

1. The libraries of a district shall be grouped together, as may be considered most convenient by the local secretary, and with the consent of the libraries formed into an union.
2. Boxes shall be provided for the transfer of books by each library.
3. Catalogues of each library shall be interchanged with the libraries of the union.
4. Every member of any of the libraries shall be entitled to the use of any book in any of the other libraries (except such as are not allowed to be taken out of the room), on giving in the name of the book to the librarian of his own library, on or before the 25th of each month. No one shall be entitled to apply who has not returned any books he has before received.
5. Each librarian shall collect and return, on or before the 27th of each month, the books received the preceding month, and forward a fresh list of those applied for. The carriage shall be paid by the librarian receiving the books.
6. No book shall be sent out that has not been six months in the library.
7. No library shall apply for more than one volume for every ten volumes of its own library. Volumes not returned shall be counted as against the library applying, and a forfeit of 1d. per week shall be paid by the person detaining a volume over two months, and remitted by his librarian to the library to which the book belongs.

MEETINGS FOR THE ENSUING WEEK.

MON. London Inst., 7, Mr. Charles Cowden Clarke, "On the Genius and Comedies of Molière."
Architects, 8, Mr. Edward I'Anson, "On some French Chateaux of the Age of Francis the First."
Chemical, 8.
Statistical, 8, Dr. W. A. Guy, "On the Nature and Extent of the Benefits Conferred by Hospitals on the Working Classes and the Poor."
TUES. Civil Engineers, 8, Annual General Meeting.
Linnæan, 8.
Pathological, 8.
WED. Society of Arts, 8, Mr. J. Kenyon Blackwell, "The Present Position of the Iron Industry of Great Britain, with Reference to that of other Countries."
Geological, 8, 1. Mr. P. J. Martin, "On some of the Geological Features of the Country between the South Downs and the Sea." 2. Prof. Owen, "On the Remains of the Musk Ox (Bubalus Moschatus) from the Gravel, near Maidenhead, Berkshire."
THURS. Antiquaries, 8.
Royal, 8½.
FRI. Philological, 8.
Society of Arts, 8, *Extra-Ordinary*. Renewed Discussion on Mr. Bailey Denton's Paper, "On the Under-Drainage of Land in Great Britain."
SAT. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Vegetable and Animal Chemistry."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette December 7th*, 1855.]

Dated 28th July, 1855.

1715. Charles Emile Paris, Paris—A new material to be used in the manufacture of crystal, enamel, and other similar products.

Dated 12th October, 1855.

2279. John Clark, Strand—Cooking apparatus for the pocket.

Dated 22nd October, 1855.

2361. Charles Lenny, Croydon—Improvements in carriages.

Dated 27th October, 1855.

2397. Edward Stark, Monkton, Isle of Thanet—Improvements in pens for writing.

Dated 1st November, 1855.

2433. James Leetch, Margaret-street—Improved method of constructing apparatus for the covering of the head.

Dated 20th November, 1855.

2610. John Poole, 2, Ryley-street, Chelsea—Improved mode of regulating the supply of steam from the boiler to the cylinder, and thereby better governing the motion or speed of steam-engines.

2612. Alfred Vincent Newton, 66, Chancery-lane—Improved apparatus for dressing flour. (A communication.)

2614. William Harvey, Mansfield—An apparatus to be employed with reals, cylinders, or rollers, and for placing upon or taking off therefrom hanks, skeins, bands, and other articles without removing such reels, cylinders, or rollers from their bearings.

2616. Charles Frederick Clark, Wolverhampton—Improvements in bolts and fastenings, which they propose calling Clark and Co's Longitudinal Wedge Bolt.

2618. David Simpson Price, 2, South Molton-street, and Edward Chambers Nicholson, 3, Newington-crescent—Improvements in the manufacture of cast iron.

2620. Oliver Maggs, Bourton Foundry, Dorset—Improvements in machinery for thrashing and winnowing wheat and other grain.

2622. Coleman Defries, Houndsditch—Improvements in the roof lamps for railway carriages.

Dated 21st November, 1855.

2626. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in treating fatty acids. (A communication.)

2628. Henry William Wimshurst, St. John's-wood—Improved machinery for cutting dovetails and tenons.

Dated 22nd November, 1855.

2630. Alexander Tolhausen, 7, Duke-street, Adelphi—Improvements in bombs and other explosive projectiles whose charges are to be fired by percussion. (A communication.)

2632. George Price, Cleveland Safe Works, Wolverhampton—A box, chest, or case, for the preservation of parchment deeds and documents from damage by steam, when placed inside an iron safe made fireproof on the vapourising principle.

2634. Henry Hibling, Norwich—Improvements in waterproof boots and shoes.

2638. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for making aerated beverages. (A communication.)

Dated 23rd November, 1855.

2640. Thomas Tuckey, Cork—Modes of construction, by which steam or other vapour or gas may be used as a source of motive power for some purposes more conveniently than hitherto, and more suitably for locomotion on common roads.

2642. John Pursloe Fisher, Edgbaston, near Birmingham—Improvements in the construction of the hammers of pianofortes.

2644. Joseph Ellisdon, Liverpool—Improvements in 'castors' for cabinet-furniture.

2646. Samuel Cunliffe Lister, Bradford, and James Warburton, Addingham—Improvements in spinning.

Dated 24th November, 1855.

2648. Samuel Ratcliffe Carrington, Stockport—Improvements in the manufacture of hats.

2650. John Jephson Rowley, Rowthorn, near Chesterfield—Improvements in machinery for cleaning and cutting turnips and other roots.

2652. Juliana Martin, Soho-square—Improved self-acting incubator.

2654. Hiram Hyde, Truro, Nova Scotia—Improvements in the manufacture of mineral oils. (A communication.)

Dated 26th November, 1855.

2658. Enoch Harrison and Hilton Greaves, Manchester—Improvements in the manufacture of woven fabrics.

2660. Thomas Greenwood, Leeds—Improvement in the construction of carding engines.

2662. George Edward Dering, Lockleys, Hertford—Improvements in galvanic batteries.

2664. James Clark, 25, Billiter-street—Improvements in the chain wheels used on capstans, windlasses, and other axes.

Dated 27th November, 1855.

2666. Thomas Allan, Adelphi-terrace—Improvements in applying electricity.

2668. Hiram Hyde, Truro, Nova Scotia—Improved manufacture of lubricating compound. (A communication.)

2670. Enoch Tayler, 62, Baldwin's-gardens, Gray's-inn-lane—Improvements in paddle wheels for propelling vessels in water.

2674. Samuel Amos Kirby, Hastings-street, Leicester—Improvements in open stoves and grates for rooms and apartments.

2676. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in sheathing ships. (A communication.)

2678. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in cleaning and hulling grain and seeds, and in the machinery or apparatus employed therein. (A communication.)

2680. Thomas Warren, Glasgow—Improvements in the manufacture and moulding or shaping of glass.

Dated 28th November, 1855.

2682. Charles Herbert Holt, Manchester—Improvements in steam boilers, furnaces for the same, and apparatus connected therewith.

2684. George Richardson, Craig's-court, Charing-cross—Improvements in buffer, draw, and bearing springs for railway carriages and waggons. (A communication.)

2686. Joseph Lee, Stonall, near Walsall—Improvements in agricultural or farmers' engines, which improvements are applicable also to locomotive engines.

2688. William Alfred Distin, 31, Cranbourn-street, Leicester-square—Improvements in cornets and other wind musical instruments.

WEEKLY LIST OF PATENTS SEALED.

Sealed December 5th, 1855.

1279. John Gedge.
1289. John Gedge.
1294. James Robertson.
1295. Henry Nunn.

Sealed December 7th, 1855.

1313. George Frederick Chantrell.
1325. William Kemble Hall.
1342. Charles Parker.
1345. Frederick Collier Bakewell.
1346. Frederick Collier Bakewell.
1347. John Avery.
1353. Joseph Betteley.
1397. Francis Burke.
1401. John Henry Johnson.
1415. Louis Pol.
1419. William Crane Wilkins.
1426. William Basébé.
1430. Auguste Edouard Loradoux Bellford.
1436. Auguste Edouard Loradoux Bellford.
1437. Auguste Edouard Loradoux Bellford.
1439. Capt. Herbert Newton Penrice, R.E.
1446. Auguste Edouard Loradoux Bellford.
1448. John Young.
1454. Auguste Edouard Loradoux Bellford.
1456. Frederick Leiss and Charles Schneider.
1465. Henry John Distin.
1476. Carl Christian Engstrom.
1528. Alexander White.
1577. Robert Yeates.
1587. Francis Burke.
1630. Edward Augustus Ferryman.
1796. Robert Barlow Cooley.
2011. John Hamilton Glassford.
2064. John Guy Proger.
2109. Alfred Vincent Newton.
2200. François Fortuné Benveanti.
2264. William Edward Newton.
2271. Jane Ann Herbert.

Sealed December 11th, 1855.

1328. John David Kind.
1340. William Beckett Johnson.
1350. William Moxon and John Clayton.
1352. Joseph Betteley.
1359. Joseph Enouy.
1364. William Hewitt.
1367. Henry Bridgewater.
1372. Dumont Pallier.
1373. William Jones.
1428. Luther Young.
1458. Moses Poole.
1502. Richard Tidmarsh.
1519. William Richard Morris and William Morris, and Richard Chrimes and George Eskholme.
1811. William Henry Lancaster and James Smith.
2039. Henry Hart.
2046. Charles Hewett.
2058. Joseph Camp Griffith Kennedy.
2254. James Murdoch.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

December 3rd.

960. Joseph Beatley.
967. Richard Archibald Brooman.
1139. John Livesey.

December 5th.

974. Edward Tucker.

December 7th.

998. Donald Beatson and Thomas Hill.
1048. James Bell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3792	December 6.	The Crochet Cotton Armlet	George Grout	Tottenham.
3793	„	Pair of Trowsers	Richard Day Charles	Bristol.
3794	10	A Steamer for Potatoes	Daniel Wm. & Thos. Bentley	Margate.

Journal of the Society of Arts.

FRIDAY, DECEMBER 21, 1855.

◆

UNION OF COLONIAL SCIENTIFIC INSTITUTIONS WITH THE SOCIETY OF ARTS.

The Council of the Society of Arts, having received an application from the Jamaica Society of Arts to be taken into Union, on the same footing as the Mechanics' Institutions of Great Britain and Ireland, have had under consideration for some time past the means of most effectually extending the benefits of the principles of association and co-operation to similar Societies throughout the British Colonies and India. With this view they have laid down the following conditions and terms of Union:—

I.—The Society of Arts is prepared to receive into Union any Institution, established in a British Colony, or in the British Possessions in India, for the advancement of Literature and Science, or for the Encouragement of Arts, Manufactures, and Commerce.

II.—It shall be the duty of the Officers of the Society of Arts to correspond with the Secretaries of such Associated Colonial Institutions, on matters relating to their recognised objects.

III.—The productions or manufactures of a Colony, transmitted by a Colonial Associated Institution, shall receive all due publicity, by means of the Society's Exhibitions, Publications, and Discussions.

IV.—The weekly *Journal* of the Society, with its other publications, shall be duly forwarded to every Associated Colonial Institution, and a portion of the columns of the *Journal* shall be reserved for Colonial Discussions and Correspondence.

V.—Whenever any member of an Associated Colonial Institution, bearing a letter of introduction from its Secretary, shall visit London, he may enjoy the usual privileges of a Corresponding Member of the Society of Arts during his stay, and may have his letters addressed to him at the Society's House in the Adelphi.

VI.—The Council will afford their advice and assistance to any Colonial Associated Institution which may desire to obtain in England or France any scientific or educational apparatus, and will obtain and furnish to any Colonial Associated Institution reports on any produce sent over for examination.

VII.—A Colonial Associated Institution shall have the privilege of purchasing books through the Society's agency on the same scale of reduction as is now granted to Home Associated Institutions.

VIII.—The system of examination proposed to be instituted by the Society of Arts shall be extended so as to embrace candidates who shall have duly attended classes at Colonial Associated Institutions, and Certificates of Merit shall be awarded by the Society's examiners on examination papers duly authenticated and remitted from the Colonies.

IX.—A Colonial Institution may be admitted into Union on the same terms as a Home Institution, namely, an annual payment of two guineas.

(By order,)

PETER LE NEVE FOSTER, M.A.,
Secretary.

Society's House, Adelphi, London,
19th Dec. 1855.

FIFTH ORDINARY MEETING.

Wednesday, December 19, 1855.

The Fifth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 19th inst., Joseph Glynn, Esq., F.R.S., in the chair.

The following candidates were balloted for and duly elected:—

Clarke, William
Gassiot, John Peter, F.R.S.
Pritchard, George

The following Institution has been taken into Union since the last announcement:—

406. London (Newington Causeway) Tailors' Labour Agency Literary Institute.

The paper read was:—

THE PRESENT POSITION OF THE IRON INDUSTRY OF GREAT BRITAIN, WITH REFERENCE TO THAT OF OTHER COUNTRIES.

By J. Kenyon Blackwell, F.G.S.

The civilised nations of the globe manifest at this epoch, in so marked a manner, tendencies to assimilate themselves and to approach each other, not only by their mental culture and their activity in the domains of thought, science, and art, but, in so far as their geographical position, their climates, and the resources of the lands they respectively occupy permit, to follow and rival each other in the same industrial and commercial pursuits, that it becomes evidently necessary for those of them who desire not to be left behind in this friendly rivalry, to take care that no valuable means of success are neglected on their own part.

It is, therefore, important in this point of view for all of us to take advantage of the opportunities afforded by those industrial, scientific, and artistic assemblages, such as that of the great French Exposition of this year, in order to examine our own resources and those of other nations, to compare their progress with our own, and to estimate correctly our present position and our future prospects; moreover, to do this in no unfriendly spirit of rivalry or jealousy, but with the full persuasion that the material resources of each of us are common property, and that the progress made in each art or science, and in the development of each branch of industry, will contribute to the common benefit of all.

The Great Exposition just closed in Paris, has confirmed and fully established the international character of these assemblages, and has given them a definite and permanent position, which they will continue to occupy in the future, after having already filled it with so much importance and success in the past.

The iron industry of Great Britain rests equally on her mineral resources, her geographical position, and the manufacturing and commercial activity of her community. We are all aware that it has reached a condition of great development and of economic importance. The quantity of iron made annually in this island alone is, nearly, if not quite, as large as the total of the quantities produced in other countries; the cost at which it is produced is lower, but it must be admitted that its quality is generally inferior to that of foreign iron.

Great Britain is not only the largest producer of iron, but at the same time both the largest consumer and the largest exporter of this metal. It is not only necessary to fulfil some important function in almost every art or industry, but it supplies the raw material for a great external commerce. It is indeed so universally necessary in its functions in arts and in industry, that some writers have taken its consumption in each country as a measure of their relative position among civilised communities.

The annual production of pig or crude iron appears, from a careful comparison of various authorities, to be at the present period nearly as follows:—

	Tons.
Great Britain	3,000,000
France	750,000
United States of America	750,000
Prussia	300,000
Austria	250,000
Belgium	200.000
Russia	200,000
Sweden	150.000
Various German States	100,000
Other Countries	300,000?
	6,000,000

It is proposed in the present paper to take first, a general view of the mineral resources of those countries which are the principal seats of the production of iron; secondly, to examine the nature of the various processes followed in this manufacture, and to inquire how far they appear to be susceptible of improvement; and lastly, to give some account of the evidences of progress in this industry abroad, as compared with this country, derived from the specimens exhibited at the Paris Exposition.

It will not be possible to bring the whole of these subjects within the limits of the paper read this evening. It will, therefore, terminate with the first part of this review. The other parts of the subject will be resumed at the earliest convenient opportunity.

The ores of iron, employed in the manufacture of that metal, may be divided into the following five great classes, namely, the magnetic oxides; the anhydrous hæmatites, including the micaceous and specular ores; the crystalline carbonates, or spathose ores; the earthy carbonates, under which great class must also be ranged the black-band carbonates; and lastly, the hydrated hæmatites and brown iron ores. This class will embrace the most modern deposits, or bog ores.

Iron is found in nature in other combinations; in the state of silicate, either alone or associated with magnesia, lime, or alumina; united with sulphur, phosphorus, or arsenic, and occasionally with other metals.

The above classes, however, embrace all those ores which are valuable in iron smelting. The iron in these ores exists in the state of oxide, mixed, to a greater or less extent, with earthy matter.

The magnetic oxides are found principally in the gneissose and other primary rocks. They occur in these formations both in veins, assuming the form of beds, conforming to the strike of the enclosing rocks, and in unconformable masses. These ores supply the great works of the Ural region in Russia, and those of Sweden. They are found in Norway and in Lapland. They also occur extensively in the primary region which stretches up the Atlantic coast of the United States through Virginia, Pennsylvania, New Jersey, Northern New York, Vermont, New Hampshire, and Maine. These ores are said to be largely developed in Nova Scotia; also on the southern side of Lake Superior, and in Missouri. They are met with in the Dartmoor region, in Cornwall. They are doubtless extensively found in numerous other localities, accompanying the older rocks throughout the globe.

In consequence of the association of the magnetic oxides with the primary formations, they are generally situated at a distance from coal. In the wild, forest-covered regions, where they often occur, the use of vegetable fuel in smelting, combined with the purity of these ores, enables iron of superior quality to be obtained from them.

The anhydrous hæmatites, including the compact and soft red oxides, and the specular and micaceous ores in which the oxide assumes its crystalline form, are found most abundantly in the transition formations. They are met with in veins and in irregular masses. They also frequently take the position of beds, the original constituents of which appear to have been removed, wholly, or in part, by those subsequent agencies which have introduced these ores. This species of ore is found in numerous localities in Great Britain, where it is met with chiefly in the carboniferous limestone. It occurs, however, in the Silurian and Devonian formations. Hæmatites, principally hydrated, from the carboniferous limestone, supply the Belgian works. They are found largely, chiefly of the anhydrous class, in the valleys of the Sieg, in Rhenish Prussia, and of the Lahn, in Nassau, where they occur in the Devonian formation. These ores are widely dispersed, especially in all those regions of the transition epoch in which igneous and metamorphic agencies have been prevalent. The immense deposits of iron ore in Elba, are of the class of specular ores. Hæmatites and specular ores are found largely in many parts of the United States. This class frequently ranks among the purest ores of iron.

The spathose ores, or crystalline carbonates of iron, appear to range through nearly the same series of formations as the anhydrous hæmatites. In England, they occur in the Devonians of South Somersetshire and North Devon, and in the carboniferous limestones of Northumberland. This class of ores forms the chief supply of most of the continental works occupied in the making of steel; of the works situated in the Austrian provinces of Styria, and Carinthia, in the Central Alps; of those situated on the Sieg, in Western Prussia; of those in the department of the Isère, in France; and in the province of Thuringia, in Prussia. These carbonates occur in veins and in masses. Where they have been long exposed to atmospheric influences, they are converted into hydrated hæmatites.

The magnetic oxides, the anhydrous hæmatites, and the crystalline anhydrous carbonates of iron, appear to have had their origin in the igneous agencies which, at periods subsequent to their first consolidation, have modified and introduced new mineral bodies, chiefly of the nature of metallic ores, amongst these rocks, both by the channels presented by the fissures formed by faults, and by the actual interpenetration of particular beds amongst them. In the latter case, one portion of the constituents of these rocks has been carried away and replaced by other bodies of a different nature. It is obvious that beds in which limestone forms the principal constituent, would lend themselves the most readily to this species of substitution.

The numerous and widely-dispersed regions in which the three preceding classes of iron ores occur, the immense masses in which they occasionally present themselves, and the great state of purity in which they are usually found, and the consequent facility in producing iron of excellent quality from them, would render them of the greatest value, and make them the principal sources of production, were it not that they are usually situated remote from mineral fuel. They are not developed to so great an extent in England as in other countries, and it is an interesting subject for inquiry, how far modifications in the system of manufacture, combined with those improved means of communication and transport which are now being created in all civilised countries, may permit these classes of ores to assume a more important position in the production of iron than they now occupy.

The earthy or lithoid carbonates of iron form the next class enumerated. In these ores the carbonate of iron is mechanically mixed with variable quantities of clay or silicate of alumina, and of the carbonates of lime and magnesia. These earthy matters are sometimes partially, or nearly wholly, absent, and the carbonate of iron is found mixed with organic or coally matter. It then becomes what is technically called a black-band ironstone.

The earthy carbonates, which are evidently of sedimentary origin, are spread in courses of nodules, and in continuous beds, to a greater or less extent, throughout most of the more recent formations, from the coal measures upward. The black-bands, or carbonaceous lithoid carbonates, appear to be confined to the epoch in which coal was also formed in great abundance. These black-bands pass, by varieties having little difference from each other, into coal of the splint or cannel class.

The lithoid carbonates of iron are largely developed in the carboniferous formation, where they are found chiefly in courses of nodules. Their occurrence commences in some regions in the upper limestone shales, and they pass upward through the coal measures proper toward their higher limits. Lithoid carbonates also occur in thick and extensive beds in the Jurassic formation; near the upper limit of the lias, or base of the oolites proper; and again higher as nodules, and perhaps as beds in the middle oolites or Oxford clays. They are also found extensively as courses of nodules in the Wealden series, and as beds in the green sand.

These grey carbonates, particularly those of the Jurassic formation, in which lime is abundant, and clay or silicate of alumina is not largely present, are frequently changed by atmospheric influences, and perhaps, to even a larger extent, by a species of substitution somewhat analogous to that already alluded to, into hydrated peroxides or hæmatites. The immense deposits in the Jurassic formation are thus presented in some regions exclusively as hydrated hæmatites; for example, in Northamptonshire, and widely in France (where this species of ore forms the chief supply of the iron-works); while in Cleveland, where the same class of carbonates is found, but generally in deep valleys, under a thick covering of other strata, it exists as the unaltered grey earthy carbonate.

These stratified earthy ores of iron, in which this metal remains in the state of carbonate of protoxide, and those in which it has subsequently acquired the state of peroxide, appear to have had their origin in the mineral and probably thermal waters, which, at different epochs and through long periods, rose to the surface largely charged with carbonic acid, and thus holding iron, manganese, lime, and magnesia in solution. The probably elevated temperature of these waters would also cause them, independently of the carbonic acid which they contained, to bring with them other bodies in solution, such as silica and alumina, which they would deposit in cooling In some cases these waters would probably be discharged in localities covered with water, and their mineral constituents would be precipitated in a stratified form; they would fill the crevices and fissures, and would be deposited in cavities in the existing calcareous rocks, in which they would channel courses for themselves with the greatest facility. In other cases, they would form superficial masses of pisolitic or geodic structure, agglomerated around particular centres, and covered over by the superficial and local deposits at those points.

The local deposits of hydrated peroxides, covered up by clays and sands, in which the mineral has assumed the pisolitic form, or accumulated in large geodes, are probably due to the agency of such carbonated thermal waters. But another portion of the iron ores of the tertiary formations may have been brought into its present position by denuding agencies acting upon previously-existing beds of ore, which may have been swept away, rolled and spread over other formations posterior to those amongst which they were originally deposited.

The ores of iron used in the production of this metal rarely contain any other metal in large quantity except manganese. This metal is present to a small extent, namely, from ¼ to 1 per cent., in almost every known ore. This quantity rises in some of the best earthy carbonates or clay ironstones to 2 per cent. In the crystalline carbonates, which are esteemed of so much value, and are used so largely for the production of German or natural steel, the amount in which manganese exists rises frequently to 10 or 12 per cent. This metal being one possessing a high affinity for oxygen, its function and value in the metallurgical processes to which the iron with which it is associated is subjected, may rather be from its tendency to act as a flux in the state of oxide, which it readily acquires; and from its thus facilitating the removal, in the state of slag, of the other impurities contained by the iron with which it is associated, than from any peculiar quality which its presence as an alloy may confer.

Zinc is found in combination with the magnetic oxide of iron as Franklinite. The iron smelted from this species of ore possesses peculiar qualities of ductility.

Slight traces of other metallic bodies are sometimes found in the common ores used for smelting, such as tin, lead, copper, bismuth, nickel, titanium, arsenic; but the quantities in which they generally exist are so minute that it seems questionable whether they exert any sensible effect on the quality of the iron with which they pass through the smelting furnace.

Many ores, particularly the earthy carbonates of the coal measures, contain small quantities of sulphur, in the state of iron pyrites, disseminated mechanically through them.

The earthy carbonates, the black-band carbonates, and the hydrated peroxides, or altered carbonates of the Jurassic series, contain phosphoric acid, probably in the state of phosphate of lime or magnesia. Few of the ores of these classes contain less than ¼ per cent. of phosphoric acid. In some of the earthy carbonates of the coal measures, this quantity rises to ¾ per cent.; but the iron which some ironstones containing this proportion of phosphoric acid produce, is found to be of the best quality; and, contrary to generally received opinions, is not cold-short. In some varieties of black-band carbonates, the quantity of phosphoric acid, large in all cases, rises to 1¼ per cent. The grey carbonates and altered hæmatites of the Jurassic series, contain this acid in large proportions, varying from 1¼ to 2, and in some cases, to 3 per cent. The hæmatites of this class make, nevertheless, red-short, while the black-band carbonates make cold-short iron. These hæmatites contain little or no sulphur.

The magnetic oxides, the anhydrous hæmatites, and the crystalline or spathose carbonates are, as classes, the purest of iron ores. They contain little earthy matter, in many cases little silica, and scarcely any alumina, lime, or magnesia. They generally afford minute traces only of sulphur or of phosphoric acid. As a class, however, these ores have a tendency to produce red-short iron.

It will be observed from the preceding facts, how little is yet known of the conditions which produce the distinctive qualities of iron manufactured from ores of different classes, and what a wide field for investigation on this subject yet remains open.

The immense production of iron in Great Britain rests, in the first place, upon the almost inexhaustible supplies of mineral fuel, furnished so largely and so cheaply by her numerous coal-fields; and secondly, almost in an equal degree, on the abundance of ores of earthy, or of black-band carbonates, which, in most of those coal-fields, are interstratified with this mineral fuel.

The only great coal-fields in Great Britain in which these ores, although not entirely wanting, do not occur in sufficient abundance to form the basis of a large production of iron, are those of Northumberland and Durham, and of Lancashire. The immense beds of grey earthy carbonates which are found in the Jurassic formation of North Yorkshire, now brought by railroads into close proximity to the first of these coal-fields, has already laid the foundation for an immense production of iron in the first of these districts. The ores of North Lancashire and of Cumberland might be brought with advantage to be smelted in the latter. In two of the other smaller coal-fields, namely, those of Cumberland and of West Gloucestershire, in which the carbonates of the coal-measures do not occur abundantly, the hæmatites, which exist in the subjacent carboniferous limestones, supply their place, and are raised in sufficient abundance, not only to be smelted in the localities in which they are raised, but also to be transported in large quantities, to the other principal coal-fields of Great Britain, for mixture with their clay ironstones.

About four-fifths of the iron produced in Great Britain is made, in nearly equal proportions, in the three great districts of South Wales, South Staffordshire, and Scotland. Northumberland and Durham follow next in respect to quantity; and then Yorkshire and Derbyshire, Shropshire, North Staffordshire, North Wales, Cumberland, and Gloucestershire complete the list.

The production of South Wales is still capable of large augmentation. It rests principally on the clay ironstones of the coal field. Black-band carbonates are also found in some situations in this basin. The position of the Welsh iron works permits the hæmatites of Lancashire, Cumberland, Cornwall, and the Forest of Dean, to be brought to them advantageously for smelting with their clay ironstones. Recent discoveries in Somersetshire and North Devonshire, of crystalline or spathose carbonates of iron, are likely to add another valuable class of ore to those now imported into the South Wales district.

The explored field of South Staffordshire, so rich in coal and clay-ironstones, of excellent quality for the production of iron, is, from its limited extent, compared with its immense production, progressing rapidly towards exhaustion. This coal-field appears, however, to be only an isolated portion of a much greater field, of which detached parts show themselves, rising from beneath the new red sandstone of the Midland counties, from Shropshire on the west, across Staffordshire and Warwickshire, to the Leicestershire coal-fields on the east; and the northern prolongations of which may even prove to be continued, beneath the new red sandstone, through North Staffordshire, into Lancashire and North Wales on the west, and into the coal-fields of Nottinghamshire and Derbyshire on the east. The existence of coal, at an attainable depth, beneath the new red sandstone measures of this wide region, is the most important problem which exists for solution with reference to the future mineral resources of Great Britain.

The iron produced in Scotland is, at the present period, almost exclusively derived from the rich and cheaply-worked black-band carbonates of that great coal-field; but as these are exhausted, they may be replaced by the deposits of clay ironstone, which (although now little worked, on account of their somewhat greater cost,) exist, nevertheless, in great abundance, in the lower part of the carboniferous series of this region.

The abundant supply obtained from the cheaply-worked black-band carbonates of this coal-field, has hitherto prevented the use of imported ores at the iron works situated in it, except in very small quantities. But this great coal-field, open on its eastern and western sides to two seas, and traversed throughout its extent by great rivers, canals, and railways, is well situated for the introduction of foreign ores, if needed, at its works. The black-band carbonates recently found in the north of Ireland, are now being worked for transport to Scotland. The hæmatite ores of Cumberland and Lancashire might also be brought to the Scotch works, with at least equal facility as to the works of other districts in which they are so largely used. The immense deposits of clay carbonates in the lias of North Yorkshire, might be conveyed to the works on the eastern coast of Scotland at low freights. If the existing prohibition to the export of ores from the great deposits of magnetic oxide, found so extensively in Sweden, Norway, and Lapland, should be removed, ores from these countries, and especially from Arendal, in Norway, might probably be brought advantageously into Scotland to be smelted.

The production of iron in Northumberland and Durham, rests almost entirely on the great beds of earthy carbonates, the nature of which has already been described, which exist in the upper lias measures of North Yorkshire. There are also, in close proximity to this coal-field, on its western side, valuable ores of crystalline or spathose carbonates, which occur in veins (frequently associated with galena and with calamine) situated in the carboniferous limestone lying under the coal series. The upper edges of these veins are generally changed, to a greater or less extent, into hydrated hæmatites. A part of the supply of one of the great ironworks of this district is now obtained from this class of ores, but from the very low cost at which the lias ores can be got to an almost unlimited extent, they will probably form in future the principal source of the already great and rapidly advancing make of this region, which is, no doubt, destined to take a prominent rank among the iron districts of Great Britain, as regards the amount of its production.

The quantity of iron smelted in Yorkshire and Derbyshire will probably increase. This is one of our most important coal-fields, the limits of which to the eastward are yet quite unknown. It runs throughout its whole extent, nearly parallel and sufficiently contiguous to the great liassic ore beds of North Yorkshire, Lincolnshire, Leicestershire, and Northamptonshire, to permit the introduction of these ores for admixture, at any of its works, with the clay carbonates of the coal measures with which its coal-field abounds.

The coal-field of North Staffordshire is very rich in its aggregate thickness of coal, but it is chiefly remarkable for the immense deposits of black-band carbonates which it contains. The numerous varieties of these iron ores, varying from the clay carbonate into the almost purely carbonaceous carbonate, which it contains, afford supplies not only to the iron works situated in this district, but are also largely exported into South Staffordshire and into North Wales.

The only blast furnaces in Great Britain which now exist in which the ores are smelted with charcoal, are the furnaces of the Newland Iron Company, situated near Ulverstone, in Lancashire, and at Bunawe, in the district of Lorn, in Argyllshire. These furnaces are supplied by the hæmatite ores of Ulverstone. They produce about 2000 tons annually of charcoal pig iron from one furnace blown in each district. This pig iron is converted into bar iron for steel, or sold to ironfounders, who make small castings, in which much tenacity and some degree of malleability is required, under the name of malleable pig iron. This quality of malleability is developed in it by annealing.

The preceding remarks have been directed to the subject of the future prospects of the iron industry in this country, particularly with reference to those circumstances on which the probability of its future permanence, its increase, or its contraction depend. The question as to the existence of any neglected resources for the production of iron which may exist in this country, therefore, arises in this place. In Great Britain the most favourable localities are undoubtedly already very fully occupied; but in Ireland there exist immense deposits of clay carbonates of excellent quality, which are now entirely unworked, probably on account of the small extent to which mineral fuel exists in proximity to these deposits. These deposits were formerly largely worked when the districts where they occur were covered with wood. It is a very important subject for inquiry, whether the immense resources of vegetable fuel, in the form of peat, with which Ireland abounds, and nowhere to a greater extent than in Eastern Connaught, the region in which these ores exist so largely, might not be advantageously applied to the production of iron of first-rate quality from them. Pig iron is smelted with carbonised peat in Bohemia.

The production of iron in France rests almost entirely on the widely-extended deposits of ore which exist in the Jurassic formation of that country. These ores are various in character. They are found stratified in beds, and in accumulated masses in the form of grains, of kidney-shaped concretions and of geodes, in cavities of the limestone of this formation, or lying upon them superficially. They are met with in the state of grey earthy carbonates and in that of hydrated peroxides. Many of these deposits are merely superficial, and only covered by the diluvial clays and sands. These hydrated ores, resulting probably in many instances from the destruction and re-collection of the Jurassic beds, extend upwards into the tertiary formations. They are found lying upon the latter, in many places, in the three northern departments of the Nord, the Pas de Calais, and the Ardennes.

The ores of the Jurassic series which appear to accompany the upper members of the lias and the Oxford clays, follow the range of these members of the Jurassic formation from the north and north-east, southwards through the departments of the Ardennes, Meuse, Moselle, Haute Marne, Haute Saône, Côte d'Or, through the department of the Yonne, to those of the Nièvre, Cher, and Saône-et-Loire, in Central France. The ores of the Jurassic formation are also found largely in the eastern departments of the Jura and Isère; in the south-east and south, in the departments of the Ardèche, the Gard, and the Aveyron, and again in the south-western department of the Dordogne.

The clay carbonates of the coal-measures are only found of sufficient value to work in three localities,—in the coal-fields of the Gard, of the Aveyron, and, to a very limited extent, in the coal-field of the Loire, near St. Etienne. The anhydrous peroxides and crystalline carbonates of iron are only worked at present in small quantities.

The ores of iron are disseminated to a greater or less extent over so great a part of France, that they are worked, more or less, in nearly 60 departments; but those whose names have been enumerated supply by far the largest quantities. Their production amounts to six-sevenths of the total quantity raised. This total quantity is about 3,500,000 tons, which is, however, reduced by the process of washing, which the bulk of the peroxides undergo previous to being smelted, to less than one-half of the above weight.

The ores from the Jurassic series, from the greensand, and from the superficial accumulations of peroxide, by which the consumption of the French iron-works is almost entirely supplied, are mined at a very low rate. Even when the expenses of washing and of conveyance to the works at which they are smelted is added, their cost remains low.

The smelting of the ore, and the subsequent processes of manufacture, are still carried on to a large extent in France with charcoal. Much of the ore is mined in districts which have hitherto remained without sufficient means of communication with the numerous coal-fields which exist in France. Water navigation has supplied the means in a few localities only to bring the ores to the coal by which they could be smelted, and to connect these points with the large markets. Still the advantages of carrying on a part, if not the whole, of the processes of the iron manufacture with mineral fuel, is causing iron-works gradually to spring up in all those coal-fields from which a cheap supply of good coal can be obtained; and, at the same time, the great net-work of internal communication, which the admirably arranged and complete system of railroads is now affording to all parts of France, will enable the great bulk of these ores, or the charcoal pig-iron into which they will probably continue to be converted in remote and thickly-wooded districts, to be concentrated in these coal-fields, either for smelting, or for conversion into bar-iron, according as the one or the other can be effected with the best results.

Coal is found in France in numerous and widely-distributed localities. The number of distinct coal-fields amounts to about thirty. As many of these exist, however, under conditions which lead to the conclusion, that they are only the exposed edges of larger coal-fields, the prolongations of which may hereafter be found to meet under those more recent formations which cover up the coal-measures in the direction of their dip, the number of separate fields will probably be eventually reduced, while the area which the coal-formation is now supposed to occupy may be greatly enlarged.

The area occupied by the coal-formation in France, so far as its limits have been hitherto ascertained, amounts to about 100 square miles, or 650,000 acres. This extent is not quite equal to one-fifth of the ascertained area in Great Britain; but many of the coal-fields of France, particularly those of the central and southern departments, contain seams of such enormous thickness, that the quantities of coal yielded by them will be much greater than can be obtained from an equal area in our own coal-fields.

The largest known coal-field in France is the Northern. This forms the continuation westward of the great Belgian basin. This great field, one of the most interesting in Europe, in a geological point of view, is probably prolonged under the tertiary measures of Northern France to the coast near Calais, where coal-measures rise to the surface; and it may not improbably be ultimately traced westward across the Channel, in continuous or detached portions, beneath more recent deposits, until it may be found to be united with our Somersetshire basin. This great field, broken across at Namur, and separated into three small isolated basins at its eastern termination, near Aix-la-Chapelle, follows the north-western flank of that great mass of transition strata through which the Rhine breaks its way above Cologne, to the east of which river the coal-measures again emerge, occupying the same position on the flank of this group of transition strata, in the valley of the Ruhr, in Rhenish Prussia.

In the northern departments of the Pas de Calais, the Nord, and the Ardennes, a large quantity of iron is smelted with coke from this northern coal-field, and the ores of the tertiary deposits of this region. The principal works are Marquise, Denain, and Anzin, on the north, and Mesières on the south of this great basin.

The great coal-field of Saarbruck, situated on the south-east flank of the same group of transition strata as that just alluded to, is certainly prolonged into France across the Prussian frontier towards the Moselle, near Metz. This is one of the districts which are the richest in iron ore in France; and this great coal-field, when explored and worked under the newer formations by which it is covered in this region, is undoubtedly destined to become one of the great centres of the iron industry of France. Iron smelted with coke is already produced to a large extent in the department of the Moselle, near Metz, at the works at Thionville, Briey, and Hayange.

The canals and railways now in existence or in construction in this region, which will link together all its great river valleys, (those of the Marne, the Meuse, the Moselle, and the Rhine,) will give all the facilities required in addition to its mineral wealth to make it a great iron producing country.

Passing to the southward, the next important coal-fields in the eastern departments are those of the Saône-et Loire; these are that of Epinac, or Autun; and those of Creuzot and Blanzy; the two latter forming parts only of the same basin.

The southern coal basin of Saône-et-Loire, in which Creuzot is situated, is traversed by that great system of water navigation which, by means of numerous canals, connects the Rhine, the Saône, and the Rhone, with the Seine, the Loire, and the Cher; and the arteries of which traverse a great part of the most important iron ore deposits of France. Creuzot, from possessing these advantages, was early selected as one of the most advantageous sites for large iron works, at which mineral fuel might be applied either in smelting, or in the subsequent processes of iron manufacture, for the conversion of the pig iron smelted with charcoal. This district will no doubt retain its already acquired importance, as one of the great centres of production, which its mineral resources and its geographical position have already marked out for it.

Continuing westward along the northern edge of the great central granitic plateau of France, near one of the points of convergence of this ramified system of water communication, where the Yonne, one of the tributaries of the Seine, is connected with the Loire, is situated the coal-field of Decize, in the department Nièvre. The limits of this field are not yet known. It is surrounded and covered at its edges by more recent formations. The iron works of Fourchambault are in this district.

Near the last-mentioned field, to the southward, lie a great number of coal basins, scattered irregularly over the central granitic table-land of France, some of which contain thick and valuable coal seams. In the department of the Allier, near the head of the Cher, lying between that river and the Allier, we find the coal basin of Commentry, and several others which are grouped near it. These basins furnish coal to the iron works of Commentry, Montluçon, Vierzon, in the department of the Cher, and to others which are connected by the ramified water communication already mentioned, with the rich ore deposits of the department of the Cher, and of the Nièvre.

It will be impossible within the limits of the present paper to enumerate all the coal-basins scattered over this central plateau of France. Those only which have, or are likely to take, an important position in the iron industry of France will be adverted to.

Continuing southward down the course of the Rhone in the department of the Loire, we find the great coal-basin of St. Etienne and Rive de Gier, which is one of the richest and so far as yet known, one of the most extensive in France. The clay carbonates of iron, sparingly distributed in the coal-fields of France, but so abundant in England, are found and worked to some extent near St. Etienne. Blast furnaces supplied with coal as fuel, have long existed in and near this coal-basin, but it is not so favourably situated for supplies of iron ore as the coal-fields of the Saône-et-Loire, and of the Allier already alluded to. The principal works in the coal-field of the Loire, are those of Terre Noire and l'Horme.

Passing southward from the basin of the Loire, and then continuing westward along the limits of the central primary plateau, we find the coal field of the Ardêche, and, again, further to the south-west, the important field in the department of the Gard, near Alais; while further westward in a great bay of the primary strata, are situated the coal-fields of Aubin and Decazeville, in the department of the Aveyron; the latter, like that of the Gard, dipping eastward until covered up by the more recent strata which skirt this granitic plateau.

The coal measures rise to the surface at many points in this region near the line where the more recent formations skirt the granitic plateau. They are exposed extensively at St. Gervais, and also at Ronjon in the department of the Herault. They are also met with at several points on the western flanks of this plateau, in the department of Correze, where they are in proximity to the Jurassic and tertiary iron ores of the Dordogne. These facts have an important bearing on the question with reference to the extent to which the coal measures of southern France may probably be eventually found to be developed beneath the Triassic, Jurassic, and Tertiary measures of that region.

The coal-fields of the southern departments of France, and in particular that of Aubin and Decazville, are very rich in coal. They also contain, or are in proximity to, valuable iron ores. It is highly probable that their present supposed limits will receive great extension from future explorations. They have, probably, been hitherto prevented from taking that position as iron-producing districts, which they are likely at a future period to occupy, from want of good and cheap communication with the great markets in France. These means of communication are, however, now being supplied.

There are already important iron works at La Voulte, in the department of the Ardêche, at Bességé and Alais, in that of the Gard, and at Aubin and Decazeville, in that of the Aveyron, in which coal is used for smelting.

The iron produced in France is smelted in nearly equal proportions with coke and with charcoal; and a large part of this charcoal pig iron is subsequently converted into bar iron solely with charcoal. The departments in which this production is by far the greatest, in consequence of the abundant supply of ores, (chiefly from the Jurassic formation), and the wooded nature of the regions where these ores are found, are, commencing to the north, those of the Ardennes, the Meuse, the Moselle, the Haute Marne, the Côte d'Or, the Haute Saône, the Cher, and, passing into the south-west, the Dordogne. The great production of charcoal pig iron is therefore in regions in close proximity to some of the most important coal fields of France. This circumstance, when the communications of the country become more perfect, will no doubt lead to a more complete, as it has already led to a partial, transformation of this branch of industry. The coal-fields will become the great centres of the manufacture of iron, to which either the charcoal pig iron, still produced in the regions where ores and vegetable fuel are abundant, will be conveyed for subsequent elaboration; or to which the charcoal supplied by these wooded regions will be brought, to be there applied in the conversion into wrought-iron, of the pig iron smelted with coke; whenever a superior quality of this metal is required.

So long, therefore, as large tracts in these eastern departments, in which the ores of iron are found so abundantly, continue to be thickly covered with wood, iron will be smelted in the localities where the ores occur with charcoal; but coal being a superior fuel to wood for many of the subsequent processes of elaboration, this pig iron will subsequently be conveyed to the nearest coal-fields for manufacturing into bar iron. When, however, the supplies of charcoal diminish in these regions, and the lines of communication become more perfect, the ores themselves will be all carried to the coal-fields for smelting, and the charcoal necessary for after-working, will also be conveyed to these great centres of manufacture.

The production of iron in Belgium rests on the abundant supply of valuable hæmatite ores, derived from the carboniferous limestones which form the base of the coal measures; and which are therefore obtained in proximity to the mineral fuel furnished by the great coal basin which traverses the Belgian territory in almost unbroken continuity from east to west. Some pig iron is still smelted, in the wooded region of the Ardennes with charcoal, for the purpose of conversion into wrought iron of superior quality. From the limited extent of this country, the production of iron will, in all probability, remain nearly stationary.

The production of iron in Prussia stands next to that of France among the European States. It is rapidly increasing. The resources of the Prussian States in iron ore and in mineral fuel are large. The great obstacles to the development of iron industry in this country appear to be, from the nature of her widely-spread and ill-connected territories, and from the want of facilities of intercommunication and access to large markets.

The great coal field of the Ruhr, in Westphalia, contains numerous coal-seams of good quality. It has been discovered during the last few years that there also exist in this coal-field, valuable strata of clay carbonates, and of black-band carbonates of iron, inter-stratified with the coal measures. The Ruhr, a navigable river, except when impeded by ice in the winter, traverses this coal-field and debouches into the Rhine at Ruhrort, the point where the state railway (connecting this region with Berlin, and traversing this coal-field north of and parallel to the Ruhr) strikes the Rhine and turns southward to Cologne.

This region bordering on the Rhine contains other iron ores of excellent quality in large quantities, especially in the valley of the Sieg, in the Prussian territory, and in that of the Lahn, in Nassau. These ores, which are principally of the classes of anhydrous hæmatites, and of spathose carbonates, can be conveyed at a low cost by the Rhine, to meet the coals of the Ruhr coal-field at Ruhrort, or can be sent into the coal-field itself by the Ruhr, if required for smelting there with the ores of the coal formation.

The northern boundary of this great coal-field has not yet been determined. The coal strata continue beyond the limits yet explored beneath the measures of the chalk series which cover them, and beneath which they are worked on that side. It is an important consideration to what extent they may be prolonged in that direction.

All circumstances concur to render it probable that the region in which this coal-field is situated will become an important centre of production for iron. Close to the Rhine and its great markets, the abundant supplies of coal and ore of excellent quality, which exist in this region, may be concentrated at those points where works are erected. The supply of ores will only be limited by the demand, and the cost of ores and of mineral fuel will be low. There is already a large industrial population in the region, workers in iron and in steel. Many large iron works are now rising in or near this coal-field.

The most valuable portion of the coal-field of Saarbruck, is that which borders on the French frontier, and which is the furthest removed from the Rhine. It is the proximity to this coal-field in France, of the iron ores so abundant in the departments of the Moselle, the Meuse, and the Ardennes, which renders it probable that the coal deposits in the western part of this great field will be largely used in iron making; but those iron ores being in France and not in Prussia, it does not appear probable that this coal-field will occupy the same position in the latter country. Some iron is, however, produced in the valley of the Saar, which traverses the western part of this coal basin.

Prussia possesses, however, on its eastern frontier, in Upper Silesia, near the head waters of the Oder and of the Vistula, great coal-fields, which are in the vicinity of important deposits of iron ore. The iron ores of this region are chiefly hydrated peroxides, occuring extensively in the muschelkalk which covers and surrounds these coal-fields toward their dip. These hydrated peroxides are situated in a different geological position to the iron ores of Belgium; at the same time they possess interesting points both of analogy and of contrast to them, being in both cases associated with large deposits of calamine, occuring under similar circumstances, but in different formations; these ores being found in the muschelkalk in Upper Silesia, while in Belgium the position of all these associated ores is in the carboniferous limestone.

The yield in iron of these hydrated peroxides in Upper Silesia is very low, from the quantity of earthy matter with which the ore is mixed, and which (from the fineness and lightness of the ore) it has not yet been found possible to separate by washing. The extent of these deposits, and the low cost at which they can be worked, counterbalance this disadvantage. The ore and coal in this region have hitherto been worked at some distance from each other, but it is probable that both will be eventually brought into immediate proximity by sinking through the muschelkalk, in which the ore beds occur, to the coal measures which lie beneath.

The clay ironstones of the coal measures are not largely developed in this region. In Northern Silesia, however, there are valuable ores of clay carbonates of iron in the transition formations, which are now smelted with wood, on account of the region in which they are found lying distant from these great coal-fields.

Prussia also possesses valuable ores of iron in other districts of her territory. Those of Thuringia have been long celebrated for the steel produced from them. The great development which may be anticipated in her iron industry, will probably take place principally in the large coal regions of the Ruhr and of Upper Silesia. The rate and scale of this development will depend in a great degree on the perfecting of her internal lines of communication, especially of those required within the great ore and coal-fields.

The iron industry of Austria is spread over nearly all the widely-dispersed provinces of that empire. The largest production is in Styria and Carinthia, from the great and valuable deposits of spathose carbonates of iron which exist in those regions of the Central Alps. This forest-covered land, traversed by numerous streams, will no doubt long continue to be a country in which iron, of superior quality, both from the nature of the ores from which it is obtained, and from being smelted and worked with charcoal, will be produced to a large extent.

Iron is made to a considerable extent in Bohemia. It is there obtained from several species of ore. Although Bohemia possesses large and important coal-fields, both of the carboniferous epoch, and also of the tertiary age, the iron produced in that region is still smelted and worked with charcoal or with turf. This is probably caused by the want of lines of intercommunication to facilitate the concentration of the ores in those parts of this region where large stores of valuable mineral fuel exist.

Scattered iron works also exist in Moravia and Silesia, in which ores of various species are used with charcoal as fuel. There is also a large production of iron in the Carpathian region, in Hungary. The forests which cover these regions will, probably, long maintain this species of production, or even enable it to be augmented.

In Russia and in Sweden, notwithstanding the abundance of valuable ores which exist, the absence of mineral fuel must prevent any great extension of the iron industry. The production of these countries will, therefore, remain comparatively stationary. The great deposits of ore in the latter country, might probably be rendered much more valuable, if the laws prohibiting its export were repealed.

The make of iron in Spain is very small. The process almost universally employed is of the rudest class. There are, however, in Spain, valuable mineral resources for the production of iron. The ores of Biscay, Catalonia, Arragon, Granada, and the coal-fields of the Asturias, Leon, and Andalusia, will probably, at some period, become the sources of important production.

The iron industry of the United States is already highly important, and is capable of great extension.

Iron ores of various classes are largely and widely developed in this country. Magnetic oxides accompany the primary formations which skirt the Atlantic coast, and follow them in their western prolongation through the region of the great lakes. Anhydrous hæmatites occur extensively in the Silurian and Devonian formations. Clay carbonates (frequently changed into hydrated peroxides) occur near the base of the carboniferous series in some localities, and sparingly also in the coal measures themselves, as, for example, in the Maryland coal basin, and near Hanging Rock in Ohio, in the great western Pennsylvanian field. This class of ores has not, however, hitherto been found abundantly either in the anthracite coal-fields east of the Alleghanies, or in the three great bituminous coal-fields situated in the Mississippi Valley, west of that range of mountains, that is in the great coal regions of

Western Pennsylvania, Virginia, and Ohio, of Illinois, or of Missouri and Arkansas. But these enormous carboniferous regions have hitherto been so imperfectly explored, that we do not know with certainty to what extent these ores may hereafter be found to exist in them. Hydrated peroxides form one of the most abundant and widely-dispersed ores of iron in the United States. They are found not only as changed carbonates, but independently, in large accumulations of geodes, covered by the superficial clays resting on the Silurian, Devonian, and carboniferous formations. These superficial deposits form one of the principal sources of supply to the iron works, both on the east and on the west of the Alleghany mountains.

The three great anthracite coal basins situated in Eastern Pennsylvania, (commonly called the northern, middle, and southern basins, from their relative position,) and the bituminous coal basin situated near Cumberland, in the State of Maryland, form the principal sources of mineral fuel in the Atlantic region. There are also, however, several small patches of semi-anthracite coal in Northern Pennsylvania.

West of the Alleghanies are found the three immense bituminous coal-fields already enumerated. The coal formation covers a large tract in Michigan, but no productive coal measures have yet been found in this region.

In the coal-fields west of the Alleghanies, the aggregate thickness of coal is, however, small, as compared with most of our European fields, but the superficial extent which they occupy is enormous. In Great Britain the average thickness of workable coal may be about 30 feet. In Southern France it is probably 100 feet. In the anthracite basins of Eastern Pennsylvania it may be, perhaps, 50 feet. In the coal-fields of the United States west of the Alleghanies, it is doubtful whether the aggregate thickness of valuable coal will average so much as 10 feet.

In the United States, the forests which formerly covered the whole of the region west of the Mississippi river, are beginning to disappear on the eastern side of the Alleghanies. In this last mentioned part of this country, the smelting and manufacture of iron are now carried on, almost exclusively, with mineral fuel. Anthracite coal is used at all the large works in New England, New York, New Jersey, and Eastern Pennsylvania, for puddling and rolling iron. In southern New York, and eastern Pennsylvania, it is used for smelting. The bituminous coal of the Maryland basin is used for smelting, puddling, and rolling at the works situated in that coal-field. West of the Alleghanies, the whole of the iron made is still smelted exclusively with charcoal, or to a small extent, worked into blooms with it by the Catalan process. The whole of the iron made throughout this region is, however, concentrated in the coal-fields at the points nearest to its origin, such as Pittsburgh, or Wheeling, which are found to be most convenient for its conversion into wrought iron with bituminous coal.

The extent of the production of iron in the United States is, therefore, a question to be determined in a great degree by the available means of transport; that is, by the facility with which the ores of iron can be brought into proximity to fuel. With modern means of conveyance, those distances hitherto considered insurmountable may no longer be found sufficient to impede and limit production. The immense coal-fields of this country may also be found to be, in their western parts, more productive in carbonates of iron than they are in those regions where they have hitherto been fully explored.

The districts in which iron is now produced in the United States, may be divided into those of New England, Eastern New York, Eastern Pennsylvania, and Maryland, the whole of which are situated on the east of the Alleghany range; and west of this range, into Western Pennsylvania; Western Virginia and Ohio; Tennessee; and Missouri, Illinois and Wisconsin will no doubt also soon take a position as iron-producing districts.

In New England the whole of the iron produced is smelted with charcoal. There are rolling mills at Providence and Boston, in which coal is used for puddling and rolling. The New England works are not so well situated as those in Eastern New York, and in Pennsylvania, which are connected by railways and canal navigation with the great anthracite coal basins situated in the eastern part of the latter State.

That part of the State of New York in which iron ores are found most abundantly, is situated near Lake Champlain, at the head of the Hudson River. The great deposits of magnetic oxide found in that region are either smelted where they are raised, with charcoal; or are conveyed by the Hudson to the point where the Delaware and Hudson Canal meets that river, near Newburgh, and thus brings to that point supplies of coal from the Lackawanna region of the northern anthracite coal-field, which are there used for their smelting.

In Eastern Pennsylvannia, which is the great seat of the manufacture of iron with anthracite coal, the works are scattered in several groups. The works of this region may be sub-divided, first, into the Easton group, situated on the Lehigh, at Easton and at Allentown; this group is supplied with iron ore in part from the great magnetic oxide deposits of north-western New Jersey, and in part from the hydrated hæmatites found in great masses of geodes, covered by the surface clays resting on the Silurian limestones of the district in which the works are situated, and with coal from the southern anthracite coal basin. Secondly, another part of these works constitutes the Danville group, which, commencing at the Scranton Works, near Carbondale, on the Lackawanna, continue at intervals through and beyond the limits of the northern anthracite coal-field by Danville, to the neighbourhood of Northumberland. These works derive their supply of ore from the beds of hæmatite found in or lying upon the limestones of the Silurian epoch, which rise to the surface to the north-west of the coal-field in or near which these works are situated. The Scranton Works obtain, however, their supply of ore chiefly from beds of clay carbonates lying below the coal formation. Thirdly, another group is found near the south-eastern extremity of the State of Pennsylvania, formed by the works at Reading, at Phœnixville, and at Safe Harbour, which are supplied with ores principally from deposits of hydrated hæmatites occuring in the surface clays of that region (similar in character to those of the Easton district), and partly from magnetic oxides met with in various localities; the anthracite coal used for smelting and conversion at these works being brought from one or more of the three great anthracite coal-fields of Eastern Pennsylvania by the Reading Railway, the Schuylkill Canal, or the Susquehanna River.

The remaining works situated to the east of the Alleghany range are those of Maryland; part of these are found in the wooded and mountainous region through which the Potomac flows; they smelt the hæmatites of this region with charcoal; the others are situated in the Maryland coal-field. This basin, the only considerable bituminous coal-field on the Atlantic States, is situated not far from the head of the Potomac river. The latter works are supplied partly with ore from the clay ironstones of this coal-field, and partly with hæmatite ores found in the limestones of the Silurian epoch, near Cumberland, and on the Potomac, at some distance from the coal-field.

To the west of the Alleghany range, the iron made is, as already observed, still smelted exclusively with charcoal; but it is afterwards conveyed to the nearest and most convenient points in the great Pennsylvanian bituminous coalfield, lying on the west of this great range of mountains, for conversion with mineral fuel. The principal districts in which the pig-iron of the region is produced, are first the northern district, or that of Western Pennsylvania, which embraces the upper courses of the Alleghany, Juniata, and other rivers meeting in the Ohio at Pittsburgh. In this district the ores chiefly used are hydrated peroxides, from the strata at the base of or below the coal formation. Secondly, that of Hanging Rock, in Ohio and Western Virginia. The ores of this district, which is situated on the south-western edge of the great Pennsylvanian bituminous coal-field are clay carbonates associated with the coal measures and superficial accumulations of peroxides. These ores are smelted with charcoal. Thirdly, the district of Western Tennessee. In this district valuable hæmatite ores are extensively found in the Devonian formation. They are smelted or converted into blooms by the Catalan process with charcoal in the region where they occur.

Iron works are now being established in Missouri, near St. Louis, in the neighbourhood of the enormous deposits of magnetic oxides and specular iron ores which exist in that region. These works, to which the ores will be brought by railroad, will be situated on the edge of the great Illinois bituminous coal-field. It may likewise be expected that important ironworks will also spring up on or near the northern edge of this coal-field, to which the immense deposits of magnetic oxides existing on the shores of Lake Superior will be brought for smelting or for manufacture after being smelted by charcoal in the regions where they are found.

A brief discussion, in which Mr. Fairbairn, F.R.S., Dr. Percy, F.R.S., Mr. Warrington Smyth, F.R.S., Mr. W. Bird, Mr. Joseph Freeman, Mr. R. F. Davis, and the Chairman, took part, followed the reading of this portion of Mr. Blackwell's paper; but as it had reference more particularly to the manufacturing part of the subject, it is considered advisable not to publish any of the remarks until the paper is completed.

The evening of Wednesday, January 9th, has been fixed for the reception of the second part of Mr. Blackwell's paper. An *extra* meeting will therefore be held on that day at the usual hour.

The Secretary announced that there would be an Extra-Ordinary Meeting on the evening of Friday next, the 21st inst., (this day,) for the purpose of renewing the Discussion upon Mr. Bailey Denton's paper "On the Under-drainage of Land."

For the arrangements after Christmas, members are referred to the Society's advertisement, on the front page.

INDIAN FIBRES.

The following remarks, on the collection of Indian fibres exhibited by Mr. Thomas Watson, at the Society's meeting on the 12th of December, are drawn from a letter which that gentleman forwarded to the Secretary. He observes, in the first place, that the majority have, he believes, already been brought to the notice of the Society by Dr. Royle, but still he thinks there are some which have not been previously exhibited in this country. He distinctly wishes it to be understood, that the present collection is not put foward as representing the entire of the fibres of India, as many most important ones, of the hemp family, as well as several others, are omitted. He says:—

"To commence, then, with the rougher and least interesting samples of the basts. These are from Arracan, and were furnished to the Agri-Horticultural Society of India by Lieut. P. W. Ripley, Assistant-Commissioner at that place. With one exception, they are certainly little fitted for home consumption, being coarse and inflexible, but the excepted sample, under improved preparation might very probably meet a market here, provided it could be supplied in sufficient quantity and at a moderate price, but these data Lieut. Ripley has not furnished. Accompanying these basts, the same contributor forwarded the inner barks of several large trees, one of which is among the specimens. My reason for drawing the attention of the Society to this article is, that from the absence of the outer skin, or epidermis, and the open reticulated state of this inner bark, it would appear that the natives of this place have a method of steeping or retting trees in a similar way to what we do flax.

"There is a small piece of a very delicate bast I discovered in a wild jungle tree, called the Noona, just previous to my leaving India. This tree is found all round Calcutta, in large quantities, is a rapid grower, and yields the bast with little trouble, and I think it likely it may be turned to some account.

"From the Birman territory will be found three small specimens of fibre, viz., the hybiscus, the urina lobata, and pee-law. The first has long been known to yield a good staple; the second furnishes as favourable a result, with these additional advantages—it is of spontaneous growth, and is found in large quantities. The third, from its want of length, has but little claim upon attention.

"The specimen of Bedolee-lath, from Assam, deserves especial notice, for the softness and delicacy of its structure. It is, I think, as a vegetable, the nearest approach we have to silk. Major Hannay, Commandant at Assam (to whom science is deeply indebted), forwarded this specimen to the Agri-Horticultural Society, but without the cost or quantity of production; hence no idea can at present be formed of its value.

"The same remark applies to the samples of muddar, pine apple, and Midnapore fibres, though each has been turned to account in textile manufacture. Of the pine apple there is an extremely light and delicate sample, in the nature of a scarf. The muddar has also afforded good strong cloth, and excellent paper, while the creeping plant of Midnapore, lately discovered by Mr. Cockburn, chief magistrate of Calcutta, is about one of the strongest fibres of its class in India. The most objectionable feature about it is its length, which, though ample for manufacturing purposes, is not long enough for the Calcutta market.

"The sample of *Sida Rhomboidea* was grown last year, in the Agri-Horticultural Society's garden, near Calcutta. It is a dwarf species of corcorus, or jute, but quite as hardy and free growing as the larger species, while the combination of colour, strength, and softness, endow it with vast importance and superiority.

"Of the specimens of jute little need be said, its marketable and manufacturing properties being generally known. I may, however, state, that some portions of it have undergone a process of chemical bleaching, which, while it has augmented the value, has not in the least interfered with the strength or pliability.

"The samples of aloe, and rope made therefrom, are deserving attention. This is a particularly fine rope fibre, and will in time prove a valuable auxilliary to the rope yard. Small quantities, prepared by the Bengalees, at present find their way into the rope making establishments at Howrah, at from 10 to 12 rupees a maund, equal to £26 and £32 per ton. The reason of this high price arises, I believe, from the scarcity of the plant in the vicinity of Calcutta, and the natives do not care about travelling far to obtain it; otherwise, at Chota Nagpore and other places, I was informed it was to be had in almost any quantity. The railway company from Howrah has planted a quantity of the aloe on each side of the rail, doubtless to prevent the Brahmin bulls and other cattle straying on the line. This operation, if carried out judiciously, will effect the end desired, and prove a source of revenue besides.

"The plantain of Bengal has not, I regret to say, furnished me with such satisfactory results as I had hoped for. I send you various samples, together with a light rope made from it. Its general weakness and brittleness places it much below many other fibres. As a paper pulp, under the influence of proper machinery, I cannot offer an opinion. I can, however, afford the Society the result of a rough experiment I tried, to obtain a pulp and paper therefrom last year. I had a quantity of the fibre cut into small pieces by hand, it was then soaked in water for two months, and afterwards well beaten in a wooden mortar, and again stirred up in water; my frame for taking the pulp out of this last pan was a fine bamboo sieve; with such an apparatus, it may readily be understood what a rough and wretched description of article was turned out, but it was paper, nevertheless. Although I had my product, and in thickness more like paste-board than paper, it wanted tenacity, and readily cracked, an idea that may easily be inferred from the straw-like nature of the samples. Doubtless other species afford better fibres; indeed one of the tribe, in the vicinity of Dacca, I have heard yields almost as strong a rope fibre as any is in India.

"The next article worth attention is the Danche. When properly treated it possesses amazing tenacity, and withstands the action of water and dilute acids well. It is largely grown, and seemingly little cared for beyond being made into mats for sheltering the pawn plant from the sun; afterwards the dried sticks are used for blazing the bottoms of the natives' boats when they are desirous of burning off the old pitch. Rope is made of it at Howrah, and a sample was sent to the Exhibition by Messrs. Thompson, of that place. The specimens sent to the Society afford some idea of the durability of the Danche. They were taken off sticks which formed portions of a pawn mat, and as such had done duty for six months, exposed to the trying heat of a tropical sun. It is easily cultivated, and requires little trouble after once sown, and when cut before flowering, is, as usual with fibrous plants, much stronger than afterwards; but this the natives, if aware of, pay little attention to.

"The last but most important of the specimens I shall allude to is the Rhea or China grass cloth plant; this is another of Major Hannay's contributions. There are different preparations before the Society; one portion was grown at Assam, but prepared by myself at Cossipore; the other was grown under my supervision, and likewise prepared by me at the same place. It may truly be declared to be the most important of fibrous plants yet discovered in India, and cannot fail in a few years to become an article of immense export. Hitherto, the great difficulty respecting this fibre has been to get it out of the ribbon or straw-like state. However, I can now pronounce that obstacle overcome, without recourse to machinery or expensive chemical operations, as the samples exhibited testify."

ECONOMIC MUSEUM.

A collection of articles, models, drawings, and publications, tending to promote health, comfort, and economy among the industrial classes, or to illustrate their present condition in various parts of the world, is now being formed by the Society of Arts, under the management of Mr. T. Twining, jun., one of the Vice-Presidents of the Society. Contributions and communications, home, colonial, and foreign, should be addressed to "T. Twining, jun., Esq., Society of Arts, Adelphi, London."

By order,
P. LE NEVE FOSTER,
Secretary.

Home Correspondence.

MR. P. L. SIMMONDS ON THE GUMS AND RESINS OF COMMERCE v. THE "ENCYCLOPÆDIA BRITANNICA."

Sir,—My attention has been directed to a paper published in the *Journal* of Nov. 30th, "On the Gums and Resins of Commerce," by P. L. Simmonds, in which the writer, after referring to the want of information on these substances, either in the home or foreign publications, proceeds to say:—"Grave errors continue to be propagated in standard works from day to day; even in a publication of weight and influence like the 'Encyclopædia Britannica,' most of the details in the articles, as given in the new edition—as far as it has proceeded—are nearly reprinted verbatim as issued in its pages some thirty or forty years ago."

Had this been a vague general charge, it might not have been easy to refute it; but as Mr. Simmonds has directed his animadversions to a particular department, I shall have no difficulty in proving the utter groundlessness of this reckless denunciation. Of the gums and resins referred to in the paper read to the Society, and such as I considered it necessary to notice in the volumes already published of the new edition of the "Encyclopædia Britannica," the following is the list as far as I recollect:—Aloes, Amber, Ammoniac, Anime, Bdellium, Colophony, Copal, Dragon's Blood, and Euphorbium. Of these, the first is a new article, which has no place in the previous editions; the next, amber, is a new and improved article; the next two are reprinted from excellent articles by Professor J. Thomson; the remaining five are inserted for the first time in the "Encyclopædia Britannica." Thus, instead of being reprints, *six out of the nine articles are printed for the first time in the "Encyclopædia Britannica," not having appeared before in that work at all, and the seventh supersedes the article in the previous edition.*

Although I cannot believe that such misrepresentations are intentional, yet, as they are calculated to mislead the public, and to have the same effect on the property of individuals as the torch of the incendiary, I feel myself compelled publicly to contradict them.

The "Encyclopædia Britannica" contains contributions of permanent value by writers of the highest celebrity. Many of these would only be deteriorated by alteration by other hands. Of the other articles, however, I can safely affirm that not one in twenty—I might almost say one in fifty—remains in the new edition without modification, addition, or correction, and very many are entirely superseded by new articles, while the pages of the "Encyclopædia" continue to be enriched by original contributions from the most distinguished names in science and literature.

I am advised that the injurious animadversions in the *Journal of the Society of Arts* are actionable; but as my object is only to vindicate the character of the work which I have the honour to superintend, I will thank you to give this letter a place in the next number of your *Journal*.

I am, Sir, your very obedient servant,
THOS. STEWART TRAILL,
Editor of Encyc. Britan.

Edinburgh, Dec. 13, 1855.

The Editor of the *Journal of the Society of Arts*, having forwarded a copy of Professor Traill's letter to Mr. Simmonds, has received the following reply:—

Sir,—I have to acknowledge the receipt of the copy of Professor Traill's letter, with which you have favoured me, animadverting on the brief allusion to the *Encyclopædia Britannica*, I made in my paper "On Gums and Resins," and to which I proceed to reply.

The Society's *Journal* is scarcely the place to go into an elaborate disquisition on the merit of the articles in the new edition of the *Encyclopædia*, particularly with the threat of action alluded to by the learned editor. In these days of free discussion and independent criticism, one would have supposed it would have been sufficient to let the work rest on its merits, and that no remarks from so humble an individual as myself could have any injurious effect on a work of such established character, "enriched by original contributions from the most distinguished names in science and literature."

The successive editions of the *Encyclopædia Britannica*, from the 1st, in 1771, down to the 8th edition in the past and present years, have, without doubt, contained "contributions of permanent value, by writers of the highest celebrity;" but I cannot admit that many of these would only be deteriorated by alteration by other hands. In the articles on Gums and Resins, I still think there is room for much improvement and addition, to keep pace with the botanical discoveries of late years—the chemical analyses of modern investigators, and the enlarged application of many of those substances to new purposes. Since Nicholson published his "Dictionary of Practical and Theoretical Chemistry," nearly half a century ago, a complete revolution in the whole circle of chemical operations, and of the arts and sciences, has taken place, and the text of that work, which then formed the basis of the articles for the *Encyclopædia Britannica*, the *English Cyclopædia*, *Ure's Dictionary of Chemistry*, and other works, is nearly wholly inapplicable in 1855.

But I will go through Professor Traill's defence of the articles he enumerates *seriatim*, being such as "he considered it necessary to notice in the volumes already published" of the last edition.

Firstly: "The new article," Aloes, "which has no place in the previous editions." Not coming properly within the category of either "gums or resins," but being a watery extract, aloes was not spoken of at all by me, except so far as estimating the total import in a summary at the end of my paper.

Secondly: the article Amber, the least important of the resins, is re-written to a certain extent—but no allusion whatever is made to its use in varnishes.

Thirdly: Ammoniac. With the exception of five new lines, specifying the plant that produces it, and that it is obtained in Prussia, the rest of this article is *verbatim* from the old edition.

Fourthly: Anime. Nine lines are devoted to this resin; and, with the exception of four words cut out, it is *verbatim* as in the old edition; and, I may state, that my comparison refers to the edition of 1812.

The word Arabic does not appear at all; and yet, as I pointed out, this is one of the most important gums of commerce, our imports reaching 3,000 tons annually.

Assafœtida, which occupied two lines of space in the old edition, is extended to seven lines in the present volume.

The important genus Balsamodendron receives four lines of notice, and Benzoin five lines.

Of the articles for which Professor Traill takes credit as being "*printed for the first time in the Encyclopædia Britannica, not having appeared before in that work at all!*" the important character of the information may be estimated from the space devoted to them. Bdellium has three lines, Colophony four, Dragon's Blood eight, and Euphorbium seven lines.

Elemi is also a new article of five lines.

Copal is the only article to which a fair proportion of space is accorded; but, even then, much of the information is obselete, and the plants furnishing the resins incorrect.

Those who have read the prefatory remarks in my paper, will remember that they were intended to be of general application, as to the imperfections and shortcomings of many publications, usually referred to as standard authorities, and that they were not intended to apply singly to the *Encyclopædia Britannica*. It is not necessary for me to follow Professor Traill in his defence of the other articles, as to whether there be one in twenty or one in fifty unaltered. I have contented myself with directing my animadversions to the particular subject which I was at the time discussing, and I leave impartial readers to decide upon the correctness or "groundlessness" of my remarks, merely adding in conclusion, that an excellent opportunity offers for Professor Traill to enlarge the very meagre article, under the head of "Gums," that has usually appeared in the *Encyclopædia*, and to bring down the information on this important article of commerce to the information of the present day, so as to assist the investigators, home and foreign, seeking information through the pages of the *Encyclopædia Britannica*.

I am, sir, your very obedient servant,

P. L. SIMMONDS.

8, Winchester-street, Pimlico,
Dec. 18, 1855.

THE PARIS EXHIBITION AWARDS.

Sir,—The short time at my disposal last week, on account of the lateness of the discussion, precluded my making more allusion then to the awards of the Paris Exhibition. A glance at the list of awards, by any person having some knowledge of the general trade of the United Kingdom, will convince him that an under-current has been at work in the whole affair. The Executive could not overlook, without exposing their motive, the world-wide renown of some of the British exhibitors—such, for instance, as the engineers; but in those cases where a successful rivalry in manufactures interfered with the French, the awards have been very scarce, and those of a class too low to be looked upon with any degree of pride by British manufacturers. Were it likely to "melt away" the existing reputation of British exhibitors, the contributions from England would do us a serious injury; but after all, the public are the best judges in these matters.

In those manufactures where there was no rivalry with the French, medals have been showered in profusion, even in cases where no striking invention was shown. From what I have recently heard, I attribute these singular adjudications to the intrigues of the recently-appointed and arbitrary "Committees of Revision."

It would be a safer plan for intending exhibitors in future Exhibitions to withhold their goods till they have convinced themselves that the juries are constituted in such a manner that, from the practical knowledge of its members, there would be a good chance of an equitable classification of their awards, and that these should not afterwards be tampered with.

In the carriage department of the recent Paris Exhibition, the claims of the exhibitors to at least a reasonable representation of their trade in the jury seem to have been overlooked in a most careless manner. The first-class awards in many other departments have been awarded to articles of superior and excellent workmanship, without being actually striking inventions, or produced by new processes. The English carriages show a marked progress on those of 1851, and they, at least, in common fairness, should have been accordingly rewarded. This is an example of a trade competing successfully with France in the markets of the world, and is an illustration of my former remark. However, English coach-builders seek only "a fair field and no favour," and are prepared to win their way, notwithstanding an attempt to extinguish their reputation by a side-wind. There seems to have been a mistake made as to what a carriage really is, in the classification of manufactures for the convenience of adjudication; it is as much an "art manufacture" as any trade can be which depends so much on the taste displayed in its various proportions and appointments; and it is, besides, a peculiar "mechanical manufacture," demanding very careful study and observation to accomplish successfully, and should, as such, have a fully competent jury to itself. The including such extraneous goods as portmanteaus with carriages in the classification, may show that it is still capable of improvements for future Exhibitions.

Having just received from a friend in Paris, the official list of the whole of the British and foreign awards published in the "Moniteur," I am better enabled to guess at the principle which has guided their distribution. First, I find that a proportion seems to exist between the medals and the quantity of goods sent by each state. France, naturally, from facility of access, sending large contributions to represent her commerce, receives more than a reasonable proportion, some deservingly, and many edged in to complete the required number. England (a good ally) has a larger proportion than other states, "per favour." Belgium has a proportion of rewards to the contributions. Austria, showing a variety of inferior carriages, is rewarded, though far surpassed by little Sardinia, which shows only one carriage, and receives a lower grade of commendation. Hamburgh, showing one carriage also, but putting Austria quite in the shade as regards quality, is placed in even a lower grade. It may be conjectured from these facts, that the jury of the carriage section has not been very successful in its selections; the misappropriation of some of the awards, where articles had nothing to recommend them, seems to favour the notion of a political sham having assumed the place of stern justice.

The time approaches for a reform of many of the abuses of these exhibitions of manufacture. What should we think of judges in our law courts being appointed who had not studied the law. In an almost equal degree, the Exhibition judges require to be selected from men well up in their several callings. Until the exhibitors and the public have full confidence in the justice of the awards, they will not be valued as they are intended. The surprising fact mentioned by your correspondent, that the names of 200 eminent manufactures who had been selected for gold medals had been reduced to a lower class, is likely to have been a measure of economy in the distribution of so much gold in war time. There was, in fact, no necessity for a golden award, as was shown in our Exhibition of 1851, where the Council Medal of bronze carried quite as much prestige as one of gold would have done; in fact, a mere written certificate would have economically superseded either, and, I believe, been equally appreciated by most of those who receive the highest commendation; they do not look to the fact of an award of a certain weight of precious metal, but to the acknowledgment of a rising or developed talent. Abler pens than mine will, I trust, take up the subject. I conclude with a simple fact, which has lately come to my knowledge with respect to the carriage department. One of the best carriages shown by England was altogether omitted from the list of awards; it has just been purchased by Prince Napoleon, and a high official at the Court of Holland has ordered a counterpart to be made, both on account of its excellent style and workmanship.

I remain, Sir,
Your obedient servant,
GEORGE N. HOOPER.

Dec. 10, 1855.

DECIMAL COINAGE.

Sir,—It would be a slight help to the decimal movement if in elementary works on arithmetic, the money table were amended, and made 4 farthings = 1 penny, 12 pence = 1 shilling, 2 *shillings* = 1 *florin*, 10 *florins* = 1 pound.

Yours, &c.,
HYDE CLARKE.

RELATIONS BETWEEN THE ENGLISH AND GERMAN MONETARY SYSTEMS.

Sir,—It is announced that a monetary congress, on behalf of German States, is shortly to be held in Berlin. Being aware that the *Journal of the Society of Arts* is received and appreciated by some eminent scientific associations in that capital, I avail myself thankfully of permission to submit the following computations, showing relations which actually exist, as also others which might with facility be established, between the group of monetary systems based upon the German mark on the one hand, and those based upon Troy-grain weights on the other hand.

The accomplished Berlin correspondent of the *Times* assumes, as an accepted fact, that the mark of fine silver will be treated as corresponding to two guineas of our money, so that 14 Prussian thalers already coined out of that weight, and 21 German florins to be coined out of that weight, will respectively correspond to £2$\frac{1}{10}$ sterling.

He further mentions an intention to introduce into the monetary systems of Germany, a gold coin corresponding to the English sovereign, an intention which betokens much prudent foresight on the part of German statesmen.

In my paper, read before the Society of Arts, and printed in its *Journal* of 16th February last, it was shown by what stages the United States of America had altogether discarded silver as a standard of value, and replaced their silver dollars with gold ones, leaving only silver fractions of a dollar to serve as legal tenders for small change, up to 5 dollars; a limit by one-half lower than that to which English silver coin is a legal tender.

The same paper alluded to measures taken by France, another great commercial nation, to fill up with gold coin the gaps in its currency caused by the exportation of its silver money. Did the space at my disposal permit, I could quote startling statistics, exhibiting the enormous extent to which gold has been supplanting silver money in France, down to the five-franc-piece, now coined in gold.

Germany, by familiarising her people with gold money, pursues the only course whereby to become prepared for adopting it as a monetary basis whenever German interests shall recognise its superior advantages. The American people have already bartered away their silver dollars at a considerable profit. France is rapidly, but unostentatiously, pursuing a like course, and now begins Germany's opportunity.

The interesting calculations furnished by Dr. Soetbeer (in his valuable book on "Bank und Geld Fragen," which has but lately reached my hands), shows the continued augmentation in the price of silver paid in gold. The demand for silver in China,* India, and other eastern regions, seems insatiable. Is it difficult to account for this? Supplies for enormous armies, drawn from tribes not previously commercial, create among them a need for currency, which "grows with what it feeds upon." Commerce, as she extends her sphere, draws within her influence masses of people, comparatively unfamiliar with coin, and disposed for some time to hoard it. Thus railways and trading ships, acting in some directions, and more arbitrary instruments operating in others (upon the coasts of China, Japan, &c.), inoculate myriads with the greed of money. The coin which obviously best suits a nascent trade is silver, the less precious, therefore more bulky, metal; always, and everywhere when present, the precursor, among primitive traders, of the more precious and compact money. If Great Britain, America, and apparently France, all beginning with silver alone, mark their attainment of commercial eminence by adopting gold, and filling up the interstices of their currency with the refinements of token or representative money, will not Germany, too, assert her progress towards commercial eminence, her conquests in the arts of peace by "bereitschaft," to take advantage of monetary eventualities.

I assume the absence of any prejudice which might prevent an adjustment of the new gold standard of Germany, to that which happens to be the most widely distributed common measure (in gold money) of the commercial world, just as the Spanish dollar or piece-of-eight has been as a common measure in silver. Witness the millions of sovereigns exported for years past, having been coined for the world at large, without any charge or deduction whatever, Australia now coining sovereigns out of the gold produced on the spot.

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* Vide Custom-house returns of silver exports.

GIVEN—

marks. grains. lbs. avoir.
16 = 57·743 = 82·49
£1 sterling contains 113 grains fine gold.
£511 do. do. 16 marks do.

ASSUME—

Ratio of gold to silver, 365 : 24 = 15$\frac{5}{24}$: 1.

RESULTS—

1 mark fine silver = 14 thalers = 21 florins = 21 × £$\frac{1}{10}$.

Now the least inconvenient mode of adjusting one currency to another, is by the assay. For example:—One kilogramme produces 100 Dutch florins 94$\frac{1}{2}$ per cent. fine = 200 francs 90 per cent. fine.

The assay, titre, standard, or quality of a coin rarely concerns any beyond the Mint and the bullion-dealer. Symmetrical, say decimal, titres are convenient theoretically; but, out of their original sphere, no coins are accepted as of the exact weight, fine contents, &c., ascribed to them at home. Deviations, such as mint "remedies," dirt accretions, turns of the scale, legal allowance for wear and tear, and the like, explain wherefore gold francs and gold United States dollars, though both 9-10ths assay, are never bartered against each other weight for weight; nor indeed are silver francs of different nations so bartered. (Vide my paper in this *Journal* of 16th February, 1855.) If, therefore, I suggest an assay for the new German money, which seems exceptional, no real embarrassment can result therefrom. Suppose the assay adopted be 93$\frac{14}{15}$ per cent. fine, then one mark of gold of that standard would contain precisely as much fine gold as is above attributed to 30 sovereigns.

Hence the mark of gold 93$\frac{14}{15}$ per cent. fine, would represent—

200 thalers = 300 florins = £30 sterling.

Let me now justify an assignment of the ratio of gold to silver as 15$\frac{5}{24}$ to 1. Dr. Soetbeer's tables show that in Paris, notwithstanding the double standard, the ratio of gold and silver has during the last 24 years fluctuated to the extent of about 2·61 per cent., and from 1848 to 1854 inclusive, it has fluctuated from 15·94 to 15·36. In London the range of fluctuation for the same 24 years is shown to have been about 3·86 per cent., and during the last eight years of that period the maximum ratio was 16·13, the minimum 15·12. In Hamburgh the range of fluctuation for the same 24 years is shown to have been about 3·91 per cent., and during the last eight years of the period ending with 1854, the maximum ratio was 15·84, the minimum 15·10. It will moreover be found that 15$\frac{5}{24}$ does about indicate the mean actual ratio in Hamburgh prevailing over a recent period.

Here the space at my disposal admonishes me to curtail my remarks. In thus offering my humble contribution towards the endeavours made to simplify the relations existing between various standards of value, weight, dimension, &c., I by no means expect to be ranked with those benevolent theorists who, anticipating an easily established community of standards, would meanwhile discourage progress and improvement in what happens to be really within our own control. The Royal Commission, so far as its function is to determine between rival projects for adjusting to decimal or common arithmetic the already established monetary system of the country, will virtually have little to do beyond making an election between the penny and the pound as the *norm* of decimalised reckoning. As Dean Swift would say, it is a feud between the big-endians and the little-endians. The former say—Proclaim that the twentieth of £1, or shilling, shall, after a certain date, be equivalent to 12$\frac{1}{2}$ pence instead of 12; the latter plead for the building up of a new decimal coinage upon the basis of the intact penny, discarding both pound and shilling in the process. Since the appointment of the Royal Commission, I have abstained from public controversy in the suit of "the penny *versus* the pound and shilling," being content that the whole inquiry shall be re-opened and dispassionately decided. As against the alarmists who deprecate improvement, simply because it is a change, effective service is being rendered by showing how exceedingly simple is the task before us compared with the complexities which had to be overcome in France and other countries. Mr. Henry Johnson, of Crutched friars, has recognised the proper function of the Society of Arts in practical public questions such as these, by presenting to its museum full series of existing decimal coins, their decimal multiples and submultiples, gold, silver, and copper. If to these were added the octonal, duodecimal, and other small change for the same units, which change, after circulating for a time side by side with the new decimal change, had eventually been superseded thereby, a useful practical illustration of how the difficulties have been surmounted might by that means be afforded.

Yours, &c.,

J. A. FRANKLIN.

London Institution,
Dec. 17, 1855.

Proceedings of Institutions.

HUDDERSFIELD.—The annual *soirée* of the Mechanics' Institution was held on Thursday evening, the 13th inst. in the Philosophical Hall. The hall was decorated with evergreens and banners, and over the orchestra was the motto "All can aid." Ranged round the hall were specimens of drawing and writing. Several of the best were the works of George Clayton, of Huddersfield; Alfred Walker, of Rastrick; and Amos Booth, of Kirkburton. The two last-named youths walk a distance of five miles, after their ordinary work, to attend the Institution, and five back again after the class-work is done. The chair was occupied by the Very Rev. the Dean of Hereford, supported by the officers of the Institution, as well as by the Presidents of many others in the neighbourhood. A great number of the students were also present. The evening's proceedings were enlivened by the performances of Miss Witham and Mr. Garner; Mr. J. Wood, presiding at the piano. The proceedings commenced by the Chairman calling upon the Secretary, Mr. F. Curzon, to read the report. After speaking of the gradual progress and growth of the Institution, the report proceeded to state that, after two removals, it appeared to be advisable, in the year 1850, that the Institution should possess a building of its own. Subscriptions were raised, but the aid thus obtained being insufficient, a mortgage had to be effected, of which £900 is as yet unpaid. The building contains twelve class-rooms. One—

"filled with adults, some of whom a few years since were destitute of more than the merest elementary education. Now, many of them are prosecuting the study of the advanced sections of arithmetical study, and in other departments of knowledge possess no mean acquirements. In two adjoining rooms men are still found who are spelling their way through the simplest reading lessons, or having their horny hands guided in the first use of a pen. We will now enter one of the lowest elementary class-rooms, where the boys under eighteen assemble. Most of these are from eleven to fifteen years of age. About sixty are present, following the teacher in a simultaneous lesson in grammar. By a succession of these lessons it is sought to fix the study in their minds, and, as in every other department, the pupil moves from class to class through the various branches of the science. Two of these large elementary classes may be especially noticed; one, the junior singing class, where from sixty to seventy are taught the rudiments of music, and a still larger class for free-hand drawing, where the copies of the Government School of Design are used, and from which, through the culture of these youths, the homes of the neighbourhood receive their first acquaintance with true art, and by whose aid the manufacturers may obtain skilled artisans and educated designers. The drawing classes are still, as they have been for many years. under the kind and gratuitous superintendence of Mr. Tomlinson. The machinery by which the Institution is kept in motion differs from that of most others, and, we believe, originated within its walls. The boy or adult who desires to become a member. presents himself on any of the evenings of the week at the Institution, where, at the under-secretary's office, he pays his entrance-fee of 6d., and 3½d. a week for as few or as many weeks as he chooses to join—a single week, if he pleases—either from having only a passing object, such as consulting a book, or returning to a branch of study for some special reason. If he re-enters within six months he has no entrance-fee to pay, but simply to inquire for his old card, which is placed in an alphabetical niche. ready for him at any time, and has his present payment entered against the tabulated date at its back. He passes thence to the secretary, who, after the member has himself entered his name, age, occupation, name of employer, and abode, examines him as to his present attainments and previous advantages, whatever they may have been. And it is found that although eight out of ten have derived some aid from Sunday or day school, the rest commence their education in our classes, and from the generally irregular attendance at day schools, the education they have ordinarily received is supplemented very valuably. After examination the new member receives a probationer's ticket for his classes. which is changed when his teacher certifies, and the secretary confirms, the propriety of his promotion. If he falls into arrear in his payments, as soon as the debt is a month behind he is visited by the secretary. This is a work of considerable labour, more than 900 such visits having been paid in the past year, but it is of great value, keeping the knowledge of the members well before the officers and committee, as well as the various circumstances from which the debt and generally consequent absence have arisen. If too poor to pay the 3½d. per week, and he is under eighteen years of age, he may fall into the hands of one of the 150 annual members, whose subscription mainly covers the expense of his education, diminishing the cost to the boy to 1d. per week. The presentees of the annual members were formerly wholly free. but the experience of the Institution is altogether against giving education, even to the very poorest. the youths valuing what is paid for immeasurably beyond what is given them. A library, containing about 2000 volumes. is open two evenings a week, and is under the care of four gratuitous librarians. The annual issue reaches 9000 volumes. The reading-room is supplied with nearly forty newspapers and periodicals, and is open on the six days of the week, ten hours a day. Two distinctive features, however, remain; one, an occasional coffee soiree; where the directors and teachers assemble for friendly conference, and the other a monthly meeting, the last Saturday evening of the month being chosen, where, without charge, the members and their friends gather and hear a brief lecture and a concert of carefully selected music. A very valuable feature has been introduced this year into the teaching, which also demands remark. On the Monday evening. after an hour has been spent in the customary reading lesson, the classes are collected in three of the largest rooms, and a short conversational lecture is delivered by the teachers or other friends. In the past twelve months, too, perhaps the most effective branch of the Institution has been greatly extended, a series of elementary adult classes, meeting every night in the week, occupying a couple of rooms, and attended by forty persons, whose ages range from eighteen to forty-five years, and who, on their entrance, were in some cases unable to read or write, and in every other instance were at the lowest point in education. They are the most earnest of all our students. The present state of the Institution is encouraging. Last year at this time there were of all classes of members 712. There are now 830. 147 of these are annual members, most of whom are not direct participants of the advantages of the Institution. Of the rest, seventeen out of every twenty attend the classes. It is one of the most pleasant things we have to record, that the attendances of the 600 pupils in class were. during the last week in November, no less than 1,451. The classes now number 74, of which 46 are elementary and 28 advanced. Of the elementary, 18 are writing and arithmetic, and 17 reading classes. They are conducted by a staff of 14 paid and 41 voluntary teachers. The number of members at any one time does not, however, adequately represent the area of labour in which the Institution works, as during the last twelve months, no less than 1,240. exclusive of annual members. have, for a shorter or longer period, passed through the Institution, 1,150 of whom have entered the classes. and the great majority even of those not now upon the list of actual paying members still consider themselves in connection with the Institution, only having for a time withdrawn from long hours, straitened means, illness, or other causes. Taking the gross population at 40,000, and the persons within whose range of age and sex the society has a right to expect its members, without distinction of class or means, at about 5,000, 25 per cent. annually receive some amount of instruction from the Institution. Very much more than this could be done with augmented means. The class-rooms are yet without sufficient scientific apparatus, and are not well furnished with either maps or diagrams. Many of the class-books might with advantage be replaced by more recent publications, although there are as yet few extant adapted to the requirements of Mechanics' Institutions, whilst the services of professional teachers are much more largely required. In the past year an experiment has been tried of awarding prizes for the good conduct, attendance, and advancement of the pupils. It has been attended with success. To a certain extent each of these objects has been promoted. [For a full report of this meeting, see *Journal* for October 19, 1855.]

The report concludes by stating that H.R.H. Prince Albert has given a donation of £25 for the prize distribution of 1856. Viscount Goderich, M.P., Mr. Tindal Atkinson, Mr. George Beaumont, of Bradford, and others have offered aid for the same purpose, whilst the last gentleman has contributed £2 to the library, and Mr. Atkinson and Viscount Ingestre have both promised lectures in the coming year; and Sir Charles Trevelyan, known for his report on the organisation of the civil service, has promised the forthcoming volumes of Macaulay's History of England. From Mr. Lindsay, the member for Tynemouth, a donation of five guineas has also been received. A very valuable testimony to the usefulness of the Institution has been rendered in a letter from Mr. John Brooke, of Armitage-bridge, which was accompanied by a donation of £10, and an annual subscription of £2.—The Very Rev. the Dean of HEREFORD then rose and said that, last year, on a similar occasion, they were told by the chairman, Sir Joseph Paxton, M.P., of the defects and wants in the education of our skilled workmen, and how to remedy them. Now he should be able to speak on Popular Education in general, and thus the addresses would not form a bad sequence. He observed that until very lately Mechanics' Institutes, with the exception of those in some of our large towns, had been entire failures. He was persuaded that if they ever were to be successful, either as places of class instruction in the ordinary branches of education, or of instruction by lectures in the physical and mechanical sciences, it would mainly depend on the education which was given in our elementary schools, and which was now gradually assuming a very different and improved character from what it had some ten or fifteen years ago. This improvement within the last ten years was owing to several causes;—to the efforts of the different educational societies, and also of individuals; but mainly to the Committee of Council on Education—to the inspection of our schools, the apprenticing of pupil teachers, the examination of masters and mistresses for certificates of merit, and the augmentation of salaries following upon this—and in no little measure to the recommending and making known better modes of instruction, better apparatus, and class-books for our schools. He thought that the present system was preparing the way for a more extended and national one at no distant period, and he was by no means certain that we should not arrive at this much sooner by working on for a time as we are, than by attempting any scheme which the country is not prepared to support, and which, if attempted in parliament at present, judging from last session, there is not much chance of our getting. He then referred to what, in his opinion, education was intended to do, and contended that it ought to be placed within the reach of all classes. This might, and no doubt ultimately would be accomplished by a system of local rates in aid of education. In the meanwhile, much might be done by the great employers of labour and great landowners—and he was glad to observe that some eminent firms were taking a lively interest in the education of those around them. Still he should be better pleased if he could think that this feeling pervaded the whole class of employers of whatever grade—not alone in manufacturing employments, but also in farming. He next spoke of the disgraceful state in which our educational charities had been allowed to fall, and expressed the hope that the Charity Commissioners would for the future prevent the misuse and abuse of these endowments. With regard to the Institutes, he felt that they had from want of funds undertaken to amuse the public, instead of trying with zeal and determination to educate their members. The only remedy which suggested itself was, to introduce good class instruction in all branches of knowledge likely to be useful. To do this effectually, unpaid teachers must not be relied on, but there should be provided well qualified paid teachers. This should be supplemented by systematic examination and inspection emanating from some central board. For himself he had, from much experience, come to the conclusion that government aid and inspection was invariably a benefit, and generally speaking, schools not inspected are inferior in teaching power and efficiency. He then alluded to the last annual report of the Yorkshire Union of Mechanics' Institutes, to that of Mr. Phillips, the agent and lecturer to the Union, and particularly to what was being done by the Huddersfield Mechanics' Institute itself. He afterwards referred to a very important report presented to the British Association at Glasgow this year, by a committee of men the most eminent in science in this country, (of which Lord Wrottesley, President of the Royal Society, was chairman) recommending among other things, "That professors or local teachers be appointed to give lectures in science in the chief provincial towns, for which philosophical apparatus shall be provided; and that arrangements be made for testing by examination the proficiency of those who attend such lectures." This plan if adopted would eventually give to the Mechanics' Institutes in towns where such lectures are established, a position of usefulness which they cannot otherwise attain; and although it might be too much to expect to see this carried out extensively at present, still, as is suggested by Sir Charles Lyell, it might be well to commence by establishing lectures in those towns which have shown the greatest taste for scientific knowledge,—in which from considerations of a local kind, such lectures would be likely to do most good, and to gain a permanent footing. This would be a step highly approved of by educational men throughout the country. He concluded by congratulating the Institute on the measures of success which had already attended its efforts.—In the course of his observations, he alluded to two letters he had received, one from Sir Charles Trevelyan, of the Treasury, and the other from Mr. John Wood, Chairman of the Board of Inland Revenue. The latter gentleman says, in his letter, "I shall be very glad, if on your visit to the Mechanics' Institution at Huddersfield, you find that an occasional prize of an exciseman's place is likely to promote merit, and stimulate exertion; and that a call is made on me for one appointment annually."—Several other gentlemen addressed the meeting in support of the following resolutions, which were passed unanimously:—

1. "That Popular Education, as affording one of the fundamental and most enduring conditions of national order, prosperity, and strength, deserves the hearty support and co-operation of all classes of the community."

2. "That Mechanics' Institutions, as furnishing effective means to the industrial population, by which the deficiencies of their early training can be supplied, are most important instruments of popular education, and have a strong claim upon the exertions of all for their promotion and development."

3. "That the Huddersfield Mechanics' Institution, by its regularly organised system of nightly classes for instruction in numerous departments of knowledge, offers to those whose evenings are at their own command, a profitable mode of occupying their leisure, and an advantageous opportunity of promoting their moral and intellectual advancement."

The proceedings closed with a vote of thanks to the chairman.

TUNBRIDGE WELLS.—The Useful Knowledge Institution (and, indeed, the town generally) has gained a great acquisition by the addition to its members of Mr. Joseph Simpson, late Librarian of the Islington Literary and Scientific Society, who not only materially aids the Committee by his judicious advice and hearty co-operation, but delivered gratuitously, on Tuesday evening last, an eloquent Lecture on "Lectures as a Means of Acquiring Knowledge," in which their various uses and advantages were ably pointed out, and the benefits of Institutions energetically enforced. The chair was occupied by Mr. John Field, President of the Institution.

MEETINGS FOR THE ENSUING WEEK.

MON. London Inst., 7., Mr. Charles Cowden Clarke, "On the Genius and Comedies of Molière."
WED. London Institution, 3, Mr. Robert Grant, "On Elementary Astronomy."
Microscopical, 8.
THURS. Royal Inst., 3, Prof. Faraday, "On the Common Metals."
Numismatic, 7.
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Animals."
SAT. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Inst., 3, Prof. Faraday, "On the Common Metals."

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette December* 14*th*, 1855.]

Dated 19*th October*, 1855.

2342. William Tatham, Rochdale—Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton, wool, flax, silk, or other fibrous substances.

Dated 22*nd October*, 1855.

2359. Alexander Parkes, Burry Port, Llanelly—Certain preparations of oils for, and solutions used when waterproofing, and for the manufacture of various articles by the use of such compounds.

Dated 23*rd October*, 1855.

2369. John Bellamy, Lower-road, Islington—Improvements in graining and in producing imitative ornamental surfaces, and in certain instruments or apparatus to be employed for such purposes.

Dated 29*th October*, 1855.

2409. Thomas Ato Temperton, Manchester—Improvements in shells and rockets, and other projectiles of a like nature.

Dated 6*th November*, 1855.

2495. Edward Jeffreys, Shrewsbury—Improvement in the construction of furnaces.

Dated 7*th November*, 1855.

2512. Henry John Betjemann, New Oxford-street—Improvements in expanding or extending tables. (Partly a communication.)

Dated 12*th November*, 1855.

2535. William Crosley, 16, Westbourne-park—Improvements in gas meters.

2537. Louis Joseph Frédéric Margueritte, Paris—Improvements in the manufacture of vitreous products.

2539. William Kemble Hall, 36, Cannon-street—Improvements in boilers for generating steam. (A communication.)

2540. George Cooke, Kersley, Lancaster—Improvements in flyers used in roving and slubbing frames.

2541. Thomas Hitt, Tavistock-street—A new method of obtaining power for propelling vessels and certain new propelling machinery.

2543. William Henry Aston and Samuel Hopkinson, Zetland Mill, Huddersfield—Improvements in steam boiler furnaces and apparatus employed for supplying water to steam boilers.

2545. Andrew Barclay, Kilmarnock—Improvements in indicating the pressure of steam and other fluids, which improvements are also applicable to governors and other regulating apparatus.

2547. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture or preparation of hard india rubber, and

in the application thereof to the construction of parts of textile and other machinery. (A communication.)
2549. William Henson, Bryan-street, Caledonian-road, and Henry Oscar Palmer, Castle-street, East-street, Marylebone—Improved apparatus for propelling vessels.

Dated 13th *November*, 1855.
2551. Fischer Alexander Wilson, Adelphi-chambers—Improvements in engines, machinery, and apparatus for exhausting, forcing, and lifting, for propelling on land and water.
2553. John Wilkinson, sen., and John Wilkinson, jun., Leeds—Improvements in communicating a shape or configuration to felted cloths and other manufactured fabrics.
2555. John Mawson, Newcastle-upon-Tyne—Improvements in cameras for taking photographic pictures.
2557. Robert Murdoch, Cran-hill, Glasgow—Improvements in agricultural apparatus for sowing seeds and depositing manure.

Dated 14th *November*, 1855.
2559. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in producing ice. (A communication.)
2561. James Burrows, Haigh Foundry, near Wigan—Improved apparatus for winding coals or other minerals from mines, which said apparatus is also applicable for other similar purposes, and for machinery required for forming or constructing such improved apparatus.
2563. William Barnes, 2, Royal Exchange Buildings—Improvement in connecting and supporting the ends of the rails of railways.
2565. Joseph Robinson, Denton Mills, Carlisle—Improvements in machinery for drying wheat and other grain.
2567. Charles Goodyear, 42, Avenue Gabrielle, Paris—Improvements in shoes and boots when india rubber is used.
2569. Frank Jacques, Droylsden—The use and method of preparation of a new material to be used in the process of dyeing silk.
2571. Alfred Vincent Newton, 66, Chancery-lane—Improved manufacture of electrotype printing surfaces. (A communication.)
2573. Johannes Moler, 3, Maynard-place, Hornsey—Producing a transparent photographic picture on ivory, without injuring the nature of the ivory, so as to be able to finish the picture with colours like other miniatures.

Dated 15th *November*, 1855.
2575. Franz Duncker, Berlin—A new instrument for electric telegraphs called "Despatch Distributor," which will permit despatches of various contents being communicated at the same time to one or more stations by means of one or two line wires only. (A communication.)
2579. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in carding engines for carding cotton and other fibrous materials. (A communication.)
2581. George Tomlinson Bousfield, Sussex-place, Loughboro'-road, Brixton—Improvements in breech-loading fire-arms. (A communication.)

Dated 16th *November*, 1855.
2583. Benjamin Talbott Babbitt, New York—Manufacturing soap.
2585. William Eassie, Gloucester—Improvements in hammers.
2587. James Yates and Thomas Rawlins Birch, Birmingham—Improvements in engines for raising beer and other liquids.
2589. Edward Peyton and Duncan Morrison, Bordesley Works, Birmingham—Improvements in manufacturing parts of metal bedsteads.
2591. Louis Auguste Potard, Paris—Improvements in manufacturing velvet and other similar fabrics.

Dated 17th *November*, 1855.
2593. Joseph Denton, Pendleton, near Manchester—Improvements in looms.
2595. Robert Walter Swinburne, South Shields—Improvements in furnaces used in the manufacture of glass.
2597. George Collier, Halifax, and James William Crossley, Brighouse—Improvements in means or apparatus employed in hot pressing woven fabrics, and other surfaces.

Dated 29th *November*, 1855.
2692. Arthur William Forde, 45, Bernard-street, Russell-square—Registering the number of revolutions of a wheel of a locomotive engine, or railway or other carriage, at any given period.
2694. William Irlam, Gibraltar Iron Works, Newton Heath, Manchester—Improvements in crossings for railways.

Dated 30th *November*, 1855.
2700. John Ramsbottom, Accrington, and John Charles Dickinson, Blackburn—Improvements in machinery or apparatus for measuring and registering water and other fluids, and obtaining motive power from the same.
2702. Edward Daniel Johnson, Wilmington-square—Improvement in the construction of attachable seconds watches.
2704. Richard Hancock, Great Polgooth Mine, St. Austell—Cleaning and separating ores of every description when brought into a state of low pulverization.
2706. Samuel Cunliffe Lister, Bradford—Improvements in treating so as to rework waste yarns of cotton, silk, flax, wool, or other fibre.

Dated 1st *December*, 1855.
2708. William Ward, Warrington—Improvements in looms for weaving.
2712. James Murdoch Napier, York-road, Lambeth—Improvement in drying small coal.

Dated 3rd *December*, 1855.
2714. George Harrison, Burnley, and William Mitchell, jun., Hoarstone-lodge, near Burnley—Improvements in machinery for roving, spinning, and winding worsted, cotton, and other fibrous materials.
2716. Christian Mayer, New York—Improvements in hair-trigger-locks for fire-arms.
2718. Westley Richards and Joseph Rock Cooper, Birmingham—Improvement or improvements in breech-loading fire-arms.
2720. Jules Roth, Mulhouse, France—Improvement in rollers employed in spinning machinery, and in other parts of machinery used in the treatment of fibrous materials.
2722. James Leitch, Ellenborough-street, Liverpool—Improvements in melting and blowing up sugars.

Dated 6th *December*, 1855.
2742. Charles Hawker, Fishbourne, Isle of Wight, and Thomas Parry Hawker, War Prison, Plymouth—Improved method of manufacturing cartridges.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.
2747. Ebenezer Poulson, 21, Judd-street, Brunswick-square—A new constructed engine to be worked either by steam or principally by manual labour.—6th December, 1855.
2792. Jacques Elidat de Malbec, Paris—Improvements in water-closets.—11th December, 1855.

WEEKLY LIST OF PATENTS SEALED.

Sealed December 14*th*, 1855.
1365. William Clay.
1369. Hippolyte Mathis.

Sealed December 18*th*, 1855.
1380. Richard Peaker and Thomas Bentley.
1382. Henry Bessemer.
1384. Henry Bessemer.
1386. Henry Bessemer.
1388. Henry Bessemer.
1390. Henry Bessemer.
1399. Daniel Gover.
1400. James Letchford.
1405. William Cartwright Holmes.
1412. Robert Watson Savage.
1413. Uriah Lane.
1414. Elise Cochaud.
1417. Jean François Victor Fabien.
1424. Theodore Bougereau.
1432. Oliver Rice Chase.
1470. Louis Joseph Frederic Margueritte.
1480. Auguste Edouard Loradoux Bellford.
1496. Francis Lycett.
1650. Alfred Tooth.
1970. James White.
1998. William Henry James.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

December 10*th*.
1034. John Thomas Way and John Manwaring Paine.
1073. André Cointry.
1089. Frederick Joseph Bramwell.

December 11*th*.
1042. Jules Lejeune.
1062. William Irlam.
1065. John Mason.
1090. Archibald Slate.
1128. Ephraim Mosely.
14. Charles Edwards Amos.

December 13*th*.
1071. Thomas Dunn, Hugh Greaves, and William Watts, jun.
1077. Richard Blades.
1098. George Thomson.
1119. Jean Baptiste Moinier, and Charles Constant Boutigny.
1120. Jean Baptiste Moinier, and Charles Constant Boutigny.

December 15*th*.
1079. Sir Francis Charles Knowles, Bart.
1127. John Roydes.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3795	December 12.	Perambulator	G. A. Chambers	13, Holywell-row, Finsbury.
3796	" 15.	Flower Pot	E. Israel	15, Bury-street.
3797	" 17.	The Volkommen Shirt	Grant, Brothers	Clement's-court.

Journal of the Society of Arts.

FRIDAY, DECEMBER 28, 1855.

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EXTRA-ORDINARY MEETING.

Friday, December 21, 1855.

An Extra-Ordinary Meeting was held on Friday evening, the 21st instant, for the purpose of resuming the Discussion upon Mr. Bailey Denton's paper "On the Under-drainage of Land." P. L. Simmonds, Esq., presided, in the absence of C. W. Hoskyns, Esq., who took the chair on the last occasion, but was unable to do so in the present instance, owing to his official duties, as High Sheriff of Warwickshire, calling him into the country.

RENEWED DISCUSSION ON THE UNDER-DRAINAGE OF LAND.

The Secretary stated that he had received communications from Messrs. Arkell, Bazalgette, Beattie, Blamire, and Girdwood, on the subject before the meeting, which it was desirable should be read before the discussion was re-opened.

Mr. Thomas Arkell said:—

"The principal object I had in view in attending your meeting of the 12th inst., was to assist in correcting two errors in the drainage of land, which I consider to have been attended with the greatest disappointment for several years past, and will continue to be if still persevered in.

"These are using small pipe tiles as at present made, and not putting the drains in the furrows on arable land, more especially on clay soils. These I consider to be the great evils of the present day, though not so at the time I wrote my "Essay on Draining," in 1843. The great evil then was the extreme shallowness of the draining, being but 1 foot, 16 inches, 18 inches, and 2 feet deep, seldom more than the latter, that being then considered deep draining. This error has been generally, though not wholly, remedied, and, if anything, gone too much to the extreme the other way. Still, I do not think the harm has arisen so much from the drains being put in deep, as from using too small pipes.

Pipe-tiles were scarcely known in 1843, except in an isolated district or two, so that I said nothing respecting them; but in the same Journal, Vol. 4, part 2nd, of the Royal Agricultural Society, in which my essay appeared, there is a report of Mr. Parkes, "On Drain-tiles and Drainage." It will be seen there that they were originally made 3 inches in diameter, by bending the clay over a round stick, consequently leaving a narrow slit the whole length of the pipe, which was then thought necessary to admit the water. These were found to act well. He then gives an account of the pipe-tile machine, and of land drained with pipes of one inch diameter, which was said to answer well; and no doubt it did, that being the first winter after its execution. This appears to have been the commencement of draining with pipes of so small a diameter as one inch. The next year, in 1844, the show of the Agricultural Society was held at Southampton, which I attended, and there saw Clayton's and other pipe and tile machines at work, and I almost wished I had not been so fast in draining my land, seeing tiles could be made so much cheaper by machinery than I had been having them made by hand. However, in the year 1846, I had drained a few acres with 1¼-inch pipes, about 3 feet deep, and 21 to 25 feet apart up the furrows; the ridges were not very high; they might be nearly one foot higher than the furrows. The drains acted well, and the land was tolerably dry and healthy for the first few years, but afterwards, in wet seasons, it was very wet, and appeared full of water, like undrained land, although at the same time all the drains were running, but very slowly. The land lying favourably for the purpose, each drain emptied itself into an open ditch, so that I could see each one separate.

"About that time, seeing by the newspapers that other parties who had drained their land with small pipes were suffering in the same way, it was recommended to have air drains at the top, or, open each one to the surface to admit air. I acted on the former plan, and put a much larger pipe, a 2-inch one I think it was, along at the top of the piece, and run every furrow drain into it. This had little if any effect, as in the wet seasons of 1852 and 1853—it was very wet and soft, not in spots, as if some of the drains were at fault, but generally over the piece; then, again, in the dry season of 1854 the land was in a very healthy state, thus showing the drains to be sound and in good condition.

"Now, seeing the drains are sound, but that after heavy rain they do not discharge to anything like their full capacity, I should say not above one-eighth at most, and that they continue running a great length of time after the rain has ceased, although it is not springy land, I have come to the conclusion that the water cannot enter at the joints sufficiently fast to keep it from rising above the pipes. And if the rain is of long continuance it fills the soil to the surface, which is for a time as wet as though there were no drains in it; this, of course, on clay soils, forms a mud round the pipes, and the water entering the drains naturally carries the mud with it into the crevices by which the water enters, and stops them up. Such being the case, it must be also plain that the deeper the drains are put in, the more danger in the joints silting up, from the greater amount of pressure against them. The pressure due to a head of water of 4 or 5 feet, may be imagined from the force with which water will come through the crevices of a hatch with that depth of water above it. Now there is the same pressure of water to enter the vacuum in the pipe-drain as there is against the hatches, supposing the land to be full to the surface.

"This difficulty of the water entering the pipes in so small a space, was seen by some at the time of their introduction, but the idea was pooh-poohed and ridiculed by a few of the clever ones; in fact, some went so far as to say, if there were no joints at all, the pipes would drain the land through their pores; and others said, let anyone try to carry water inside them any distance, and see what difficulty there would be; but carrying water inside is a very different thing, as the pressure would then be reversed, being from the inside. But to return to the hatches or floodgates. What does the miller do in times of drought, when he is in want of every drop of water for his mill? He does not get below the hatches, and plaster a little clay against the crevices to stop the water; that would be about the same thing as trying to carry water in a pipe-drain with the clay outside to keep it in; but he gets a shovelfull of coal ashes, and puts them in above the hatches to stop the leakage, and this has the desired effect. Now, if coal ashes will stop water, is it not plain there is danger in clay and sand stopping it under the same pressure, and the smoother and better the pipes are made, and the closer the joints fit, the more likely they will be to get stopped.

"What I should suggest as a remedy, would be to return to the slit in the pipe, say one-eighth of an inch wide, of a dovetail shape, with the widest opening inside the pipe. This would prevent the mud or sediment withstanding the pressure of the water, and would not be wide enough to allow mice to enter; and, in the inch pipes, it would give nearly four times the space for the water to enter that there is at present, and in two-inch pipes it would be twice as much. This opening in the side would not be necessary in the large-sized pipes used for the main drains, but in all those used for the furrows I think it would act beneficially. Of course it is most requisite in the smaller sizes, say all under two inches diameter.

"The extract of a letter, read by Mr. Denton, from Mr. Macvicar, of Lincolnshire, describes an exactly parallel case to my own, and, I have no doubt, the failure was caused by the inability of the water to enter the drains; for where I have used the horse-shoe tiles (with which the principal part of my drainage is done) they act as well now as when first put in.

"Putting the parallel drains at equal distances apart, regardless of the furrows, I consider a very great evil, especially where the lands or ridges have been gathering up for a great number of years, and are too high to be levelled without injury to the soil, or without going to a considerable expense.

"It will be admitted, I think, on all hands, that at times we have heavy rains, and of such long continuance that clay soils will not admit the rain as fast as it falls, and that this occurs much oftener on land drained with pipe-tiles than on that where the horse-shoe tile is used, so that the rain runs on the surface into the hollows and low places, and if the drains are not placed in the furrows or under these low places, it will lay sufficiently long to kill the wheat or any other crops that are planted. Putting the drains in the furrows, which are the low places, appears so reasonable, and carries such a common-sense view of the case with it, that to argue in its favour must appear to many altogether unnecessary and absurd, were it not that the contrary is upheld and acted on by many of those who are classed amongst the greatest authorities on draining of the present day. Is it not reasonable and common-sense, that when you want the most water to run off in the shortest time, it should have the least distance to run. Suppose the drain to be only half-way up the side of the ridge (some, of course, would be under the tops of the ridges where they are of irregular widths), but suppose them to be only half-way up the side, in these hasty rains the water would run from the whole side of the ridge to the furrow, and then it would have to filter or percolate back again through the subsoil to the drain; and this is not the worst of the evil,—when the land is drained, and the drains act properly, the water table is lowest at the drains, and highest midway between them, and this water-table rises and falls between the drains according to the quantity of rain; so that where the land ought to be in the best state to receive the water it is in the worst, from the water table being nearest the surface,—and, again, when it is in the worst state to receive water, that is in very wet times, there is most to receive, when, of course, if there is no outlet or open furrows to take the water from the surface, it stands and makes itself a bed of mud, which will hold it long after the subsoil is dried by the drains.

"Instead of putting the drains in at equal distances, supposing the ridges are too wide for one drain to be sufficient, I should say there are two ways to act, either put one half-way up the side of the ridge as well as one in the furrow, tor, which I think better, gather up a rather low narrow ridge in the old furrow, and put a drain on each side of it, in the new made furrows, keeping the land rather lowest over the drains. I have not mentioned any cases of failure to support my arguments except my own, as it is far from my wish to expose and injure any individual, but if any parties who may read my remarks, shall be able to explain any failure in their draining, and profit thereby, I shall be satisfied for the little trouble I have taken in the matter.

"After hearing the discussion of the 12th instant, I would beg to say that my remarks are meant to apply most particularly to the flat uniform clays and limestone soils that are in tillage, as the slow drainage of the pipes on grass lands may be advantageous; and that the opening in the side of the pipes may be objectionable on sandy soils, where they are apt to silt up, but on our Oxford clay and the calcareous clays of the oolites, I have never had any drains silted up, although they have been laid in from 12 to 15 years.

"With respect to Mr. Trimmer and the Keythorpe system, where there are subterraneous ridges and furrows, it is obviously right to cut across them, as the result has shown, but I am inclined to think that these are exceptional cases, and that the rule is to keep the greatest descent, and in the surface furrows.

"Mr. Thompson said, it had never been satisfactorily explained to him why the deepest drains sometimes ran sooner than the shallow ones, and sometimes not; I can easily account for it to my own satisfaction, but to explain it we must refer to the water table, or, as some people call it, the stagnant water in the soil.

"To hear some people talk on the benefits to be derived from drainage, and the injury to plants where the land is undrained, one would almost suppose the water table was always within a few feet or inches of the surface, but such is not the case. Let any one refer to a little pamphlet by the Rev. J. C. Clutterbuck, on the "Drainage and Replenishment of the Subterraneous Reservoir in the Chalk Basin of London," and he will there see how the springs and outlets are continually and gradually lowering the water table in the chalk, as soon as the wet season has passed, and although the water table may reach the surface in the height of the rainy season, that for nearly the whole of the vegetating and ripening seasons it is very many feet below. Also on the level clay land, the water table is reduced by evaporation through the spring, summer, and autumn months, probably from 10 to 20 feet below the drains, according to the dryness of the seasons. It may be more or less, but it could easily be ascertained by boring in the autumn. But, for argument sake, I will suppose it falls 10 feet below the surface. The first rains in the fall of the year are taken up by the dried soil and subsoil. It may take, probably, two inches of rain to saturate the land, if it falls steadily, without raising the water-table, and consequently not making the drains run. Now, supposing the soil fully saturated down to the water-table, the first rain, in excess of this, begins to raise the water. It is possible, I think, for one inch of rain then to raise the water-table from 10 to 20 feet, or more, in a clay soil, where the pores are so fine that the water rises in the subsoil. It, of course, reaches the deep drains first, which begin to run before it touches the shallow ones. Then, supposing after some continuance of rain it ceases, and both deep and shallow drains have lowered the water table again to their respective depths, as is the case at the present time in Wiltshire, and in the winter season only will it remain at the level of the drains without rain for any length of time, when very little vegetation or evaporation is going on, so that the next rain we have, the drains will immediately run, in consequence of its meeting with the watertable, and, if anything, the shallow ones first, but the difference would be scarcely perceptible."

Mr. J. W. **Bazalgette**, engineer-in-chief to the Metropolitan Commission of Sewers, said:—

"The discussion on the 12th inst., on Mr. Bailey Denton's able paper, showed very plainly that in spite of all that has been written and spoken on the subject of land-drainage during the last ten years, we still want data for comparing the relative value of pipes at given depths for carrying off rainfall; whereas, upon a number of carefully recorded facts, it would become easy to base sound theories. The terms deep and shallow drainage are vague in the extreme, and we have, at present, no sufficient information as to the real effect of 3 feet, 4 feet, and 5 feet drainage, upon the same and different kinds of soil.

"We want to know, with showers various in density and duration, on different kinds of soil, what proportion of the rain will pass off through the surface channels, and what proportion through the under drains; and whether this latter proportion is greater with deep or shallow drainage? Again, we want to know how soon, after the rain commences, the drains begin to run, and how long they continue to discharge after the shower is over; comparing the results of the 3 feet, 4 feet, 5 feet, and 10 feet drains in this respect?

"I put out of the question the value of drains 4 feet deep and upwards, for increasing the temperature of the soil.

"Some of the farms already drained must afford excellent opportunities for such observations, the results of which carefully recorded, and collected, cannot fail to be of national benefit. I would, therefore, suggest to those gentlemen who have the opportunities, and are desirous of advancing this science, that a rain-guage should be fixed in a convenient position, near to the outfall drains, and the quantities of rain falling noted every five or ten minutes during heavy storms. A thin plate of tin, or iron, with a rectangular opening at the top, should be placed as a dam across the lower half of each outlet, and the depth of the water flowing over these weirs, at the same time recorded. During uniform and continuous rains, it may be sufficient to make these observations once in every hour. The operation is so simple, that an intelligent and careful farm foreman could, after a short time, be entrusted with it. The required information might be periodically forwarded to the Society of Arts, in the form of tables, similar to, or modifications of, the following specimen:—

Locality.

Description of soil.

Size, depth, and distance between branch drains, whether laid with collars or not; and date of construction.

Number of outfalls, with the diameters and inclinations of each.

Number of acres drained through each outlet (accompanied by a plan, if possible).

Length of rectangular opening or weir.

Date.	Rain.		Time of noting the depth of rain in the guage.	Depth of water in the rain-guage, in inches & decimals.	Period of guaging the discharge at the outfalls, noting the time when it commenced and ceased.	Depth of water at outfall.				General Remarks.
	Commenced.	Ended.				Number 1.	Number 2.	Number 3.	Number 4.	

"These tables will not only show the quantities of water drained out of the soil, and the rapidity with which it is abstracted from it by drains of different depths, after it enters, but they would also become most useful records respecting the phenomena of rainfalls, and their effects upon agriculture.

"Should my suggestions be acted upon, I shall be most happy, in a future letter (for the benefit of non-professional persons) to publish the rules by which the actual quantities of rain falling, and the proportionate quantities carried off by the surface and subsoil-drains, may be calculated; or, so important do I consider the inquiry, I will myself undertake to perform this part of the investigation.

"I may mention, in conclusion, that rain guages may be had in London for about thirty shillings each, with explanations as to their use."

Mr. **James J. Beattie** (of Aberdeen) said—"I have just glanced over the paper in the *Journal* of the 14th, and beg to say that I concur in the views entertained by Mr. Denton. There are several particulars that I should have liked, had time permitted, to lay before the meeting of the 21st, corroborative of the depth of furrow drains not being less than 4 feet, and the effect produced in improving the climate where drainage has been pretty extensively carried out.

"At first (1846) drainage was begun here at shallow depths, but in the course of two years it was gradually carried deeper, until 4 feet was generally adopted at distances apart of 24, 27, and 30 feet, the latter being the greatest distance that I countenanced. I may mention that the sum expended under my directions, arising from loans from government and private outlays by the owners of land, since 1846, is about £200,000.

"The nature of the ground over this and the adjoining counties is exceedingly variable; indeed, it is not unusual in a drain of 6 or 7 chains long, to pass through three or four different descriptions of subsoil. A great part is difficult to cut, from the number of stones and large boulders imbedded in hard gravelly clay. The expense, therefore, is much beyond the cost spoken of by Mr. Denton, being here from £6 to £9 per acre. Pipes and collars are now invariably used by the most experienced drainers.

"I have discontinued trench ploughing immediately after drainage. I observe that the soil when drained subsides in dry periods and expands during wet seasons, so that an action takes place naturally sufficiently strong to break up even the moorband pan which is so frequently met with in this district. This is more apparent where the drains have been deep and not far apart. I have recommended old grass land that had become in its wet state tough in the surface, to be left at least two years unbroken up after being drained. The grass improves in quality, and the land, when afterwards ploughed, is friable and mellow, more easily prepared for cropping, and produces better crops. The saving of labour is also very great, particularly when it comes to be prepared for turnips. The green surface is replaced on the drains and rolled down flat.

"Before adopting 4 feet deep drains, I had much difficulty in dealing with the iron ore which generally appeared at two to three feet from the surface, but by the extra depth the water filters off to the pipes free of ore. Occasionally iron ore is found at a greater depth, but the floating substance is then in most cases lighter, and does not adhere to the pipes in the same way as that found near the surface."

Mr. **Wm. Blamire** (of the Inclosure Office) said, "the Commissioners have no suggestions to offer, but in my private capacity I take the liberty of stating, that I do not think the attention of the public has yet been directed to the important results arising from the system of deep drainage in as forcible a manner as it might be."

Mr. **John Girdwood**, in a letter addressed to the Chairman of the meeting, said, "that in order to obtain any practical benefits from such discussions, the subject in hand must be much more closely adhered to, and the discussion confined within the limits which Mr. Bazalgette endeavoured in vain to draw attention to on the last evening." He further suggests, "that some such arrangement as the following would be useful:—1st, What are the aims and objects of land drainage, and what have been its results. This is necessary, as there are some important questions involved, which must guide all our future steps, as, for instance, Is drainage of land to be considered as mere water channelling, or has it other aims affecting the quality of the soil? 2nd, What principles ought to guide us in fixing the direction of the drain? 3rd, What depths ought to be used, and on what grounds are they to be fixed, &c."

Mr. **T. Scott**, on being called upon by the Chairman, said—After fifteen years' constant connexion with the execution of extensive works of land drainage, watching the results of our various practices, and reasoning on the principles by which those practices were guided, he thought we had arrived at a sound solution of the problem, as to what constituted thorough and permanent drainage, based on the theory of Mr. Josiah Parkes. Mr. Smith of Deanston's practice had, shortly before Mr. Parkes's time, superseded the wayward operations of local districts to such an extent as to have become almost a national system, causing the expenditure of hundreds of thousands of pounds, not altogether unprofitably, but still without a principle to guide it, for it appeared to him (Mr. Scott) that Mr. Smith never had got hold of one. About ten years ago, Mr. Parkes brought reasoning to our aid, and showed how dependent the effectiveness and permanency of drainage (the latter especially) was, upon the application of sound principles in its execution. Smith's teaching ceased to be followed; much drainage executed according to his rule, became effete, and was taken up and replaced by deeper drains; time confirmed the practice, and now, when we were settling down to our work with a satisfactory confidence, our equanimity was suddenly disturbed by the rise of the "Keythorpe system" of Lord Berners. He had read Mr. Trimmer's paper on this system in the *Journal of the Royal Agricultural Society*, and had heard Lord Berners's verbal explanations, but he was still at a loss to know if it was of national application, or simply adapted to the locality in which it was practised. Even there, we had not had its application guaranteed to us as a *permanent improvement* by an authoritative report from the Enclosure Commissioners, or other recognised public functionaries. He had never in his practice met with such a geological formation as was said to exist at Keythorpe, except in such large areas as to admit of their being drained in the usual *gridiron*, or parallel fashion. As economy was one of its features, we had every inducement, however, to study its merits, and to avail ourselves of the invitation his lordship has so liberally given us to make a personal inspection. In 1838 he (Mr. Scott) served his apprenticeship to land draining on the farms of Mr. John Dudgeon, in West Lothian, and in that and the two following years superintended the execution of 140 miles of drainage, executed at Mr. Dudgeon's own expense, as a tenant on the farms of Almondhill and others, on the principle recommended and then practised by his friend Mr. Smith, of Deanston. These drains were dug 27 and 30 inches deep, the conduits being formed by 2½-inch tiles and soles, or 12 inches of stone broken to pass through a 2½-inch ring. The effect of this drainage was wonderful and repaying at the time; but when he wrote to Mr. Dudgeon in 1850, just ten years afterwards, to know the result, he learned that having become alive to the superior advantages of deep drainage, he (Mr. Dudgeon) with the concurrence of the landlord, had terminated his old leases several years before the date of their expiry, that he might have the inducement, which the beginning of a new lease would afford, to take up these very 30-inch drains and re-lay them four feet deep, which he had done. Here was a *material guarantee*, by one of the leading and most acute tenant farmers in Scotland, that deep draining on the stiff and cold subsoils of west Lothian, was the most effective and remunerative drainage. Having gone into Cheshire in 1841, and remained in that county for nearly seven years, he (Mr. Scott) there applied and carried out the system he had learned. He thus drained upwards of 1000 acres of land, superseding the "Fishbone" system, which was the only one then known and practised in the stiff clays in that county, the depth of such drains averaging only 20 inches. For the execution of these works he received a silver medal from the Manchester and Liverpool Agricultural Society in 1843, and again in 1844. The depth, as well as the inclination of this drainage, was ridiculed at the time by his local friends, and the landlord began to doubt the propriety of putting his money into such a *sinking fund*, and the tenants were unwilling to promise a per centage on the outlay. But what was now the result? Why, the landlord, agent, and tenants, were all superseding these drains, though many of them were three feet deep, with deeper ones still, the minimum being 3 feet 6 inches. It was, therefore, with some degree of humility that he held this handsome medal for work now obsolete in principle and being superseded in practice, but he had rather blush for the past than hold out against reason and experience for the future. The rules of the same Society now say, "no drain to be less than 36 inches deep, but the Society recommend it still deeper." The drainage he had spoken of was executed on the estates of R. E. E. Warburton, Esq., and the Lord de Tabley. He now came to a happier epoch in his draining experience. In 1850, he went into the county of Wilts, as resident agent to Joseph Neeld, Esq., M.P., and being then fully convinced of the soundness of deep draining, and hoping that his Wiltshire friends might not know how much comparatively shallow draining he had been guilty of, he commenced by draining from 3½ to 5 feet deep, on all soils. Being a stage in advance of local practice, a war of words ensued with the tenants and neighbours, but he persevered for three years, and until nearly 2000 acres of land in Wilts and Somerset had been thoroughly drained in this way, being supported by the confidence of the proprietor throughout. At the end of the time mentioned, he began to perceive that he was being followed, but still at a respectful distance, by a good many of his early, but thinking and observing, opponents, and his mission ended by a handsome testimonial being presented to him as an acknowledgment that he had practically exemplified in that district a sound system of land drainage. Three more years had rolled by, and time had so far confirmed the result, that the ordinary farmers in that district were now deep drainers from experience, if not from principle. He thought that no stronger proof could be adduced than these examples, that 3 feet 6 inches was the minimum depth for drains on the stiffest soil, for permanency and effect; and though such drains might be put too far apart, as Mr. Mechi had recorded from his own experience, all drains sunk to a less depth *must* be too shallow to accomplish these two objects. As a further proof of this, he had evidence that the late Mr. Wm. Smith, of Braydon, near Swindon, in Wiltshire, executed some drainage on his own lands there in 1812, 4 feet deep and 20 feet apart, and though this was the most unporous soil and subsoil, he believed, in the three kingdoms, these drains were still running, and the land was effectually dry. He wished also to record here the result of an experiment which he made in 1851 with Fowler's Draining Plough, on 150 acres of the Braydon land, and which land Mr. Bravender, of Cirencester, had described in the *Journal of the Royal Agricultural Society*, as almost untractable. This drainage was done by contract, 3 feet 3 inches deep, and 16½ feet apart, the main drains being dug by hand and laid with 3 and 4-inch pipes, the outlets having grated pipes built in stone work, and the minor drains being left without pipes, except for about 12 feet in length from the main drains upwards. The economy of this work was great; sheep were now folded with advantage on the land, which was formerly unsafe for cattle, except for about three months in the year; the aquatic grasses had died out and better herbage had taken their place, and the annual value of about 100 acres of the grass land so drained was doubled. The average cost of this comparatively deep draining on Mr. Neeld's estates did not exceed that of the shallow and temporary operations previously in vogue in this district, namely, £4 an acre, on 1,800 acres of thorough drained land, labour being then at least 30 per cent. less than it is now. That the drainage was *thorough*, he had good reason to believe, from not having heard a single statement to the contrary from any of the thirty or forty occupying tenants over whose farms the drainage extended. An assistant of his (Mr. Seal) who superintended and measured the whole of this drainage, and now occupied one of the drained farms, said—"In no case have I found the deep drains fail on the most tenacious soils, and the same may be said of those on springy land." Mr. Seal had also given him some interesting facts relative to the supposed impervious soils of Strathfieldsaye, and which he (Mr. Scott) commended to the notice of Mr. Bullock Webster. He said—"My father, who was land steward on the estate when purchased for the Duke of Wellington, and for many years afterwards, drained the greater part of the park, upwards of 35 years ago, at various depths, in some instances more than four feet deep, using tiles without soles, and covering them with heath—the result was satisfactory. A great part of the Speaker's land which adjoins Strathfieldsaye is also very stiff, but, notwithstanding, it will draw very well four feet deep." Mr. Easton, the present agent at Strathfieldsaye, confirmed this practice to him by stating—"On the stiff clay lands we put in the drains 3 feet deep, and 15 to 20 feet apart; on the more loamy soils 4 feet deep and 35 to 40 feet apart, and 25 years' experience proves to me that this answers well." If any one was at a loss to discern why 4 feet drains might be placed further apart than 3 feet drains, and still be more effective, he had only to consider that 4 feet drains removed the water 12 inches farther from the surface, and left some 1,000 tons more dry soil per acre above the drains. The vacated water tubes in this large mass of soil then became air cells, and rainwater reservoirs in turn, and thus both of these elements were continually imparting to the drained soil ammonia and nitrogen, the most concentrated and essential food of plants, changing and ameliorating the most noxious subsoils to the depth of the drains. Four feet, then, appeared to him to be a settled standard of depth for minor drains on the great majority of soils in this country, and he thought this principle had been so well reasoned by scientific scholars and eminent engineers, and so carefully arrived at by practical men, that it would not now be easily disturbed. The principles then, which were so important, being now settled, mainly by the sound and deep reasoning of Mr. Parkes, and which Mr. Bailey Denton had lent no unimportant testimony to confirm, our next most important study should be the careful execution of the work. Relative to the advantage of draining, it was now too late in the day to speak—no one disputed it—it was an admitted fact, and to dwell upon its sanitary or agricultural benefits would be as unnecessary as to elaborate on the advantage of the sun's rays. The necessity of good pipes, though not yet alluded to in this discussion, was of vital importance. Whatever their shape, they must be well burned, and never less for any drains than 1½ inch in diameter, smooth inside, and well rolled at the ends to prevent their internal capacity being diminished by ragged edges. He had laid on the table a specimen of what a pipe ought to be, and also a new kind of junction pipe to connect the minor with the main drains. When a field had been drained, it should be immediately mapped for reference. He had always practised this, and would just give one illustration of its utility. Professor Simmonds, of the Royal Veterinary College, was lately advised by him to take a considerable farm in the neighbourhood of London, part of which he (Mr. Scott) had drained five or six years ago. The ditches round one of these drained fields had been neglected, and some of the drains were stopped up, but the professor did not know where to put his hand upon the evil, and wrote to him. He immediately obtained for him a copy of the drainage map, and he was thus enabled to dig down upon any drain or point of a drain he wished. Another and still more important point to be attended to when the drainage was finished, especially on large estates where it had been extensively carried out, was to appoint a steady and experienced hand as "drain-mouth inspector," who should be continually going about, seeing that all the out-falls were clear, and all the ditches kept below the level of the drain-mouths. He had always carried this out in his own practice, and found it a great satisfaction, and saving of money in repairs. To prevent the ingress of rabbits, rats, or other vermin, it was advisable always to adopt some kind of grating. His practice was simply to insert a three or four barred wire or wrought-iron grating between the third and fourth pipes; it was thus secure from injury, and always within the reach of examination. Thus far he had spoken from personal experience alone. If he now looked back to the previous night's discussion, he confessed he was at a loss to say what anyone coming to learn, and intending to drain, could gain by it. Some seemed to adopt geology as their guide, others abstract principles, while the aids of practice, eyesight, and common sense were very much overlooked. Now, he thought the latter qualifications had a good deal to do with the practical part of the question. Deep drainage was now the rule, and shallow the exception; but when we took that for granted, we must use the qualifications he had named, to modify it, and suit it to local peculiarities. As far as he could judge, Mr. Denton appeared to him to have adopted correct principles, and to be guided by sound personal discrimination. It was a curious coincidence that Mr. Denton's estimate, in 1855, of the sum required to drain all the wet land in Great Britain, £80,000,000, was the same as that calculated by him (Mr. Scott) in 1850, and recorded in a paper on Land Drainage, read before the Chippenham Farmers' Club, and published in the *Farmers' Magazine* for March, 1851. If both these estimates were correct, it showed that the rise in the value of drainage labour and material since 1850 was equivalent in amount to the whole expenditure in draining between that and the present time, probably £10,000,000. He demurred to Mr. Denton's apparent desire to draw the expenditure of all borrowed capital under the control of public drainage companies. The idea of giving drain-pipes to farm tenants, to bury as they liked, he had seen to be a most impolitic practice; but it would be equally impolitic to bring all the draining in this country into the hands of Act of Parliament companies. For his part, he did not see why they should continue to possess the monopoly they now did, and why entailed proprietors should not be at liberty to borrow on the most advantageous terms from anyone, whether a private individual or public body, to drain their lands, and give permanent or terminable charges on their estates, if the work were sanctioned and passed by the Inclosure Commissioners. In Ireland, the Board of Public Works was the great monopolist, preventing all private enterprise from going there, either individually or collectively, to facilitate the drainage of land by loans, and only itself advancing driblets to private owners, and these under the most embarassing restrictions. One great good done in Ireland, however, was the opening up of the national arteries of the country. Here, we impeded them by thousands of petty corn mills, and there was no immediate sign of these impediments to land drainage being done away with, although the value of the extra produce that would thus be obtained from the lands at present injured by back water, or altogether excluded from tillage, would probably exceed the money value of such water-power. That Scotland was all but a completely-drained country, he had often thought, from observation, and we might infer as much from Mr. Denton's figures, for we found that £1,424,682 of a recent public loan had been expended there, with perhaps ten times that amount of private capital, in addition, on an area of 5,000,000 cultivated acres; while England had not expended even so much public money, and probably not more private capital, on an area six times greater. We thus saw the important work that was still before us in England, and had good reason to commend the practice of land drainage to the fostering attention of our great national association, the Royal Agricultural Society.

Mr. **Bullock Webster** was sorry to disagree with so many authorities on the subject before the meeting; but he did differ in opinion materially as to the advantages of a uniform depth of 4 feet in strong clay subsoils not surcharged with under-water. It appeared from Mr. Denton's able paper, that more than two millions of money had been expended on drainage during the last few years, either government loans or borrowed from companies. Now what had we learned from that large expenditure? He quite agreed with Mr. Denton, that the results of the practice of the last few years had confirmed the principle, that depth might govern distance in soils of an uniformly open and porous nature; that in the denser clay soils this compensating principle was inadmissible, much clay land having been drained imperfectly from having been drained two widely. In lands suffering from springs, or from pressure of water, where each drain should be designed for a special service, there was no dependence on one drain upon another, and, therefore, no rule of distance could apply. He also agreed with Mr. Denton in opinion as to the arrangement of the drains—that the result of the practice of the last few years had shown that the principle of parallel equi-distant uniformity was applicable only where there exist uniform texture of soil, and uniform inclination of surface; that it required modification directly the soil varied, and the surface became irregular, and that the desire for uniformity had led to a waste of money and imperfect work. He did not agree with Mr. Denton, when he said five four should be the minimum depth for all drains, and "that it is difficult to admit of a compromise of depth under any circumstances whatever." Experience had shown us that porous subsoils could be drained more effectually and economically with deep drains, and that springs should be cut off in the confined measures at various depths before they had injured the land below them; but he contended that soils resting on retentive clay subsoils not surcharged with under-water, (he was not speaking of subsoils with veins of gravel and sand containing water) should be drained not less than three feet deep, but that the depth must be regulated by the extent to which the clay cracks, and to where the water was checked by the retentive nature of the subsoil, for his opinion was, that these particular soils required drainage, because the water did not get into the subsoil, not because the subsoil was full of water. Our object, then, was to tempt the water through all the soil we could, and then get rid of it. Effectual three-feet drainage left no water below the drains; they were out of the way of all agricultural implements; roots of plants would as freely go into a four-feet drain as a three-feet one, if they had a tendency to stop up a drain. As to water running clearer out of four-feet drains than three, Professor Way's experiments had proved a much less depth of soil above the drains would extract all valuable matter from rain water or manure. He thought it would be found that the temperature would be quite as high on those lands drained three feet as four feet. He objected to the four-feet drains on these retentive clay subsoils, because you could not get your drains further apart, as Mr. Denton admitted. He objected to them because the extra foot, after three-feet, often costs nearly as much as the first three feet. He objected to them on account of the expenses of the out-falls in many cases, and the subsequent annual expense of keeping these outlets open. Let the roots of the crops be kept within the influence of the sun, in eighteen inches of well-manured soil, and he thought it would be found that the produce would be far more than if you tempted them into four-feet of clay subsoil, if you could do so. With regard to the deep drainage on the clay at the Duke of Wellington's estate, at Strathfieldsaye, it was tried and given up some years since. He was not aware of what was being done there now. He could show an estate in that neighbourhood where deep drains at wide intervals did so little good, that drains closer together and not so deep had since been put in. With regard to the Keythorpe system, he spent some days there the end of last October, and although there had been several days' rain, he never saw land in a more perfect state for all agricultural operations, and he did not think it fair of people to say anything against this drainage till they had seen it, and he believed Mr. Denton had not. We often heard of the retentive clay subsoils completely changing their character by the action of four-feet drainage; now he had frequently seen strong clays exposed a whole summer to the sun and rain in brick-yards, year after year, and yet they remained much the same. A soil might be altered by freeing it from water, and admitting air, but beyond the depth to which it was moved, no very great change would take place in the dense clay subsoil. He felt confident that many estates in this country would not cost half the money to drain, if all the main outlets were well opened, the springs cut off, and some of the upper lands laid dry, and then left for a year or two before the rest of the drainage was proceeded with.

Mr. G. **Donaldson** said, as he had for many years been engaged in works of land drainage, though not of late so employed, he still took much interest in the subject, which was one of the greatest importance, not merely to the agriculturist, but to the community at large. He regarded drainage as merely one step, and that a most important one, in the cultivation of the soil—for on a very large proportion of our lands good cultivation was quite impracticable until the soil was freed from superfluous moisture. It might be regretted that so many conflicting opinions had been upheld by those who had studied and practised draining, as it tended to throw doubt and difficulty in the way of those who wished to ascertain the best method; and possibly it might have led to the expenditure of money in inefficient work in some instances; but as this diversity of opinion and practice tended to excite attention and discussion, and to lead to a record of the effect of each method, it would eventually bring them to a knowledge of the best system for general adoption. Speaking of the results of draining, he would mention a piece of land in Clydesdale, which he drained in 1821-2. The land was previously so wet and boggy, that it was unfit for cultivation. It was drained on the Deanston system from three to five-feet deep, and the third year after it was drained it produced a crop of wheat of six quarters to the acre, and 64lbs. weight per Winchester bushel, and had ever since been in profitable cultivation. And he might mention another instance—that of a field of nearly 300 acres on the granitic formation, also in Lanarkshire, which had never previously been cultivated, producing only a mixture of coarse grass and heath of little value; but after being thorough drained it was ploughed up, and produced a crop of oats which sold by public auction at £9 an acre, and the land was let for a second crop (let for one year only) at £11 per acre. Much had been said as to the proper depth of drains, or what was called deep and shallow draining. Now he believed that no general rule as to depth and distance apart would apply in all cases. What was deep for some lands would be shallow for others, and the most advantageous depth in each case must be decided according to circumstances. Some remarks had been made as to the depth to which the roots of various crops penetrated the soil, and the value of the crop no doubt greatly depended upon the depth of active soil available. Now it was well-known that the roots of plants penetrated the soil only so far as the atmosphere had prepared a way for them, but the atmosphere was inoperative in a soil surcharged with water, hence the utility of drainage. There were, however, two or three kinds of water to be dealt with in draining; first, the surface water from rainfall; then there was deep water which rose from below; and these must be differently dealt with. In most cases a few well-placed drains would suffice to dry many acres of under-water, while the removal of upper water required a greater number of drains of less depth. Again, of under water, some was more hurtful than others; for instance, in the South of Devon, where irrigation with spring water was successfully practised, there were to be found frequently in the same farm what were called cold and warm springs. The water from what was called the warm springs had a singular effect in fertilising the soil, while with the cold springs it was quite the reverse. Now, in draining the land of under water, wherever it was of the nature of those cold water springs, the deeper it was drained away the better, while in removing water of the quality of those so called warm springs to a great depth, was less necessary, as the land was not so benefited thereby. The various qualities of soils should be well understood, and also their capabilities of improvement, in order to their being economically dealt with in draining. The question of depth in drainage ought to be decided by the depth of active soil requisite for profitable cultivation. The best test of efficient drainage was to be found in the temperature of the soil. The superior value of a deep, warm soil, was well-known, and the object of draining was to give depth and warmth to the soil. There were soils, some clay soils, for instance, in which no under water was found, and no great depth of drain was requisite for removing the surface water, but the drains should be deep enough to give such a depth of active soil for cultivation as might be desirable, even though a less depth of drain would carry off all the water. In many instances, great difficulties were experienced in obtaining outfalls, owing to water-rights on the course of rivers for mill-power, irrigation, &c. It was very desirable that the legislature should devise some means of obviating this, and it was equally so that records should be kept of the action of drainage, by a registry of the rainfall and the discharges from the outfalls; these records would become of great use as data for calculating what discharges ought to be provided for in future works.

Mr. R. B. **Grantham**, C.E., wished to remark upon the latter portion of Mr. Bailey Denton's paper, in which he refered to the question of main outfalls for drainage. Some few years since the Earl of Carlisle had introduced a most valuable Bill into the House of Lords for this purpose, but nothing whatever had since been done towards that most important national object. The measure consisted in forming drainage districts, and appointing trustees to superintend them; and he considered that very great benefits would arise to the country if such a measure were adopted, so as to give power to lower bridges and culverts under public roads, straighten and deepen rivers and streams, and deal with the rights which would be effected by such operations over large tracts of country. But above all the removal of mills, dams, and other obstructions in rivers, which in many cases did incalculable injury, many times exceeding the value of the mills, by keeping up the levels of rivers, and rendering it totally impossible to drain the adjoining lands by pipe or any other kind of drainage. He wished to impress it upon those who are interested in the improvement of land by draining, that they should use their influence to procure from the legislature next Session, such a measure as would enable subsidiary drainage to be more effectually carried out; and he hoped that this Society would also use its influence to promote such an object. He was not advocating any particular plan, but thought that some such provisions as those contained in Lord Carlisle's Bill, under the control of the Inclosure Commissioners, would answer the purpose. He had for some time past paid much attention to some of the suggestions contained in Mr. Bazalgette's communication, and had prepared some tables for his own guidance, by which the sizes of main pipes to drain given areas could be determined, having especial reference to the discharge of water at certain inclinations, both of the minor pipes and the main pipes, and one with the other, as also the relative widths at which pipes should be laid apart, having reference also to the discharge of water at certain inclinations. He thought that it would be difficult to procure the return in the form which Mr. Bazalgette had pointed out, as many who are really interested in agricultural land drainage would not take so much trouble as it really was when properly undertaken.

Mr. R. F. **Davis** said the matter just stated was so important, that he could not refrain from making a few observations relative to it. If they were to go into the Midland districts, they would see great injury done from the damming up the water for mills. In the valley of the Nene they would not see less than a dozen such mills, which threw the water back upon the land. If the farmers of this country had not been indifferent with regard to undrained lands, they would not have seen their canny friends north of the Tweed obtaining so large a portion of the government loan as they had done. In draining lands some years ago, he found that 4 ft. 6 in. was the best depth for retentive clay soils. At first he stopped at 3 ft. 6 in., but afterwards found he had to deepen the drains to 4 ft. 6 in. Lincolnshire was an evidence of what might be done by district drainage. From a comparative marsh it now presented the finest arable land in the country. He was rather astonished to hear the remark that deep drainage was only necessary for a sandy soil, inasmuch as that would not hold the water. What they wanted to do was to draw off the cold water, which was unhealthy to the land and destroyed its powers of vegetation; and Mr. Parkes had quite settled that deep draining was the only effectual system. He considered it was the stiff clayey soil that required most draining, and from 4 ft. to 4 ft. 6 in. he thought was about a proper depth. A Lincolnshire farmer, ten years since, who paid £400 a year rent, told him he must give up the farm, or that if he went on without drainage he must take off £100 a year. He replied that he should increase the rent to £450 a year, and charge 6½ per cent. on the amount expended in draining. The year after the drainage he gave the farmer £25 to spend on oilcake, upon condition that he would spend £50 for a like purpose. This was on a farm of 175 acres, and last year he was told upwards of £250 was spent on oil cake, and £500 a year was readily paid for the farm. The cropping for ten years was, 3 crops of wheat, 1 of oats, 1 of barley, 1 of beans, 2 of seeds, 1 of rape, and 1 of turnips. This was working the land, and some persons maintained that there would be a falling off in its value, but where under the old four-crop system it would only produce from 4 to 4½ quarters per acre, it now produced 7 quarters. That was the result of drainage. It was too often found that for the drainage of land, the landlord found the tiles, leaving the farmers to put them in. That plan would never succeed—the work must be done by an engineer. The landlords ought also to see to the outlets being properly kept, for on half the estates in England where £1000 had been spent in draining, the expenditure had been useless, from the flow of the water having been left to John Smith or Joe Williams, who knew nothing about the subject. It was no use draining land without being provided with a good plan of the drainage. Drainage was frequently rendered of little avail, from the tiles being put in without any plan by which they could be traced. A tenant farmer once told him that some grass land did not produce so much after draining as before. Probably it did not in the first year. In the second, however, it was better, and in the third he saw lambs and ewes on it in February. In the fourth and fifth years it was still better, and in the sixth he did not believe it could be surpassed. No doubt it was originally a wet grass, which would not grow in a dry soil, and therefore the difference was not seen at first. The grass upon a dry soil might not appear so luxuriant, but the backs of the beasts would soon tell whether they had been fed on a wet or dry grass. He was anxious to impress upon both landlords and tenant farmers the advantage of drainage. Land should be drained in such a manner as not to put the tenants to any expense. Some landlords found tiles for drainage, but taxed the farmers to find the horses and carts for their conveyance. Why should they do so? By draining, the landlords were adding to the value of their own lands, and ought therefore to pay for it. In lands he was connected with the tenants paid 6½ per cent. on the outlay for drainage, and he found they were benefited to the extent of not less than 10 to 15 per cent., and in some instances even to the extent of 30 per cent. Once more he impressed upon them never to leave the drainage to be carried out by unskilled hands. A man should be no more his own drainer than his own doctor, or make his own will.

Mr. **John Clutton** stated the result of his experience to be, that in the generality of soils, and in clays especially, drains should be laid at a depth of not less than four feet; that in the strong clays of the Wealden district, and in Dorset, &c., experience had proved that pipe drains four feet deep were, if not placed too far apart, more effective in draining land than any of a less depth. When he

(Mr. Clutton) began business 30 years since, he found his father making drains three feet deep, of broken stones and chalk; but the whole of the lands so drained had been for some years, re-laid with pipes, at a depth of not less than four feet. He (Mr. Clutton) stated he was not aware of a single instance of deep drains having been replaced by shallow ones, but he knew of numerous cases of shallow drains having been replaced by deep ones. It was remarkable, he thought, that there was not an advocate of the shallow system of draining in the room, with the exception of Mr. Webster, whose arguments tended to show that the strong clays were pulverised and ameliorated to the depth of the three-feet drains, but it did not appear to strike him that if the drains were laid at four feet deep, the clays would be converted to that depth into active soil, adapted to the growth of plants. The effect of deep draining on clay soils was not only to alter their texture but also to change their colour,—a yellow clay becoming, in a few years, a good hazel loam. These changes were not effected at once, but were brought about gradually, by the operation of worms, insects, &c., working together to the water-level, whereby the atmosphere was more readily admitted with the rain-fall water, which imparted to the soil, to the increased depth, all the advantages so well pointed out by Professor Way, in his recent lectures to the Royal Agricultural Society. He (Mr. Clutton) had had considerable quantities of three-feet drains taken up as quite ineffectual to dry the land, and the land re-drained at depths of not less than four feet, by which it had been effectually dried. He gave an instance of a dairy farm in Dorsetshire, upon a very stiff blue clay, drained four feet deep, where the stock had been increased at least 25 per cent., and a flock of sheep kept where none could live before; while upon an adjoining farm, on which three-feet drains had been laid, the land was unimproved, and remained nearly as wet as before the drainage. He could not agree with Mr. Denton in recommending that the number of acres draining to one outlet should never be more than twenty, as he had found by experience, that the largest possible amount of interior drainage should be carried into sufficiently large main drains; indeed, as a question of ultimate advantage and economy, he would, if it were possible, take the whole drainage of a farm into one outlet, as few tenants were found who would pay the necessary attention to the mouths of drains; and as the number of mouths was increased, so the danger to drainage, through oversight and neglect, was increased. This last point of outfall brought him to the consideration of the arterial drainage of England, and to the very insufficient power at present existing to enable owners to obtain increased depths for the outfall of drains and watercourses through the lands of adjoining proprietors. The legislature, from a desire to protect private rights, had not hitherto granted sufficient enabling or compulsory powers for the improvement of the arterial drainage of England; and without controlling and sufficiently compulsory powers many districts in this country could not be beneficially cultivated. The time, he contended, had now arrived when authority should be given to commissioners, or other competent parties, to carry out the works necessary for the proper drainage of the districts requiring it; and he urged the impolicy of landlords entrusting to tenants and others, not qualified by education and experience, the execution of drainage works, and showed the danger of supplying tenants with tiles, and allowing them to put them in, without the supervision necessary to insure the proper formation of the drains. Engineers and others who devoted their time and attention to the subject should be employed to lay out the drainage of land, and see to the proper execution of the works. One-half of the drainage hitherto constructed was inoperative, because the necessary — and he might say the essential — knowledge and experience of scientific draining engineers and surveyors had not been called in to aid the local—and it might be he practical—knowledge of the tenant or bailiff, to whom the works had in too many instances been intrusted. Without intending any reflection upon tenants generally, it must be admitted that they did not appreciate the difficulties attending the proper laying out, and the execution of a comprehensive scheme of thorough drainage. The necessity for a correct plan of drainage, executed on a comprehensive scale, could not be too strongly urged. Without this, drainage works, however, well executed, would become deranged—if not destroyed—in a few years, as the direction and outfalls were forgotten; and he would again urge that where the outfalls were numerous, they were the more likely to be forgotten or neglected than if the drainage of large tracts were concentrated and carried into mains of large dimensions, whose magnitude would command attention.

Mr. Hewitt Davis said his experience in draining had been so decidedly in favour of what was termed deep draining, that he had long ceased to drain shallower in any soils than four feet, whenever a fall of that depth could be gained; and he gave four feet as a minimum depth, because he was convinced occasionally that there were soils and conditions where it was advisable to go much deeper. The wetness of the surface of land appeared to him to arise from two different conditions of the soil, and that these called for different systems of draining, both as regarded depth and distance. He considered most soils, and more particularly what were called "strong," were made wet by the surface water sinking only a short distance and accumulating in the pores and fissures of the subsoil until it reached the surface, and it was with this standing water that the drainer usually had to operate, and he gave four feet as the minimum depth of the drains in these soils, because he had always found that the cracks and fissures formed by the drought and changes of temperature, on the strongest clay, and which made these soils permeable, extended below this depth, and the water from the surface might be made to reach the drains at this distance. He did not advise going deeper when the object was merely to take off the surface water, because the difficulty and expense then too rapidly advanced to admit of doing so with advantage. As these descriptions of soils were made wet by water that soaked perpendicularly, and rested in the soil, and called for draining solely to rid them of water that reached them from the surface, they were only to be laid dry by parallel drains down the fall, at widths regulated by the depth of the drains and the facilities that the openness of the soil offered for the water to draw into the drains. The other description of draining solely applied to land that was made wet by land-springs, or water which reached it from a distance, as well as from its own surface, and was brought to the surface by the cropping out of the impervious strata on which it lay. It was to this description of land that Elkington's system of draining by spring-tapping was applied with so much success a hundred years ago as to gain him a parliamentary grant of £5000. He found that by cutting up the hill and across the clay into the watery bed upon it, that he frequently succeeded, by means of a single deep drain, in laying a considerable distance dry; but we must not forget that his success lay in dealing with land made wet by water brought to it and oozing on to its surface, and in intercepting it before it came to the surface. Had he (Mr. Davis) heard Lord Berners's description of his soil, and its watery fissures, previous to Mr. Trimmer's account of it, he should have understood that he had dealt with land springs or water brought from a distance, and that he had succeeded in laying it dry upon Elkington's system of cutting through the side of the strata that basined it in; but this system of draining could be applied only to particular soils and circumstances, and the greater advantages from parallel draining were found to still more narrow the field for its adoption. With respect to Mr. Bullock Webster's remarks, with reference to 4 feet and shallower drains, and his objections to the rule "that depth should govern the distance between the drains," or, in other words, "that increasing the depth in clay to 4 feet extended the distance they drew," he need say little, for every farmer's experience in ditching and water furrowing was against him; and Lord Lonsdale had well exemplified the effect of depth in drying the land, by saying that he early learnt the greater benefit of depth in his experience in road making, from observing the assistance that deep draining the road-sides gave in laying the ground between the drains solid, and he (Mr. Davis) appealed to Mr. Denton to say whether or not he did not find that the deeper the drains on all soils the wider they drew. He (Mr. Davis) began draining 25 years ago, by laying bushes two feet deep, and a rod apart, but he soon found that by going deeper the drains drew farther and laid the land drier; and for the last 20 years he had never drained less than four-feet deep.

Mr. J. Bailey Denton was glad of the opportunity of saying a few words in reply, and they would be addressed rather to what took place on the first evening's discussion than to that which had occurred that night, to which he had very little objection to raise, for every opinion expressed seemed but to confirm the principle of depth for which he contended in his opening paper. They certainly went very far from the objects of the discussion, when they listened so long to what was said with regard to the Keythorpe system; and he said this because so little was understood in what was stated. Without detaining the meeting on the Keythorpe question, which he hoped to say a few words on presently, he would refer at once to the remarks made by the various speakers at the last meeting. Objections were made to his having omitted certain topics. He believed Mr. Hewitt Davis went so far as to say that he should have gone more at length into the theory of draining. Another gentleman said he ought to have discussed more in detail the practice; but he thought the objections made were undeserved, for it was not from underrating the importance of the omitted topics that he left them to be spoken of by other persons, but because he had not time to enter upon them. He thought, as Mr. Scott stated, that we ought, after ten or fifteen years' experience, to have come to some conclusion upon principles which should govern our practice. We ought to be in a condition to confirm those views that practice had shown to be sound, and to reject others, without discussing the first principles of drainage at this period in the progress of the art. On the last occasion there seemed to be altogether wanting a right knowledge and appreciation of the several elements with which we were dealing in draining. The various speakers confined their observations to the one object of discharging injurious water; they disregarded the benefit and influence of air on the soil. Others disregarded the force of gravity in carrying water, which is 815 times heavier than air, through a soil rendered permeable to both by draining to an approximate depth of the drains. Mr. Clutton had shown that evening the effect of air and water admitted by drainage into the subsoil. Lord Berners, on the contrary, stated the other evening that water would not percolate through clay. His lordship stated this without giving any proof of the fact, and left the meeting without explaining where and how he had conducted the experiment upon which the assertion was based. It was a fact, however, that some of the lias clay (to which his lordship particularly alluded) had been effectively drained at a uniform depth of four feet and upwards; and he (Mr. Denton) was prepared to show that such clays were as homogeneous in character as any clays in the country. Lord Berners spoke of the cheapness of his drainage, and to this point he (Mr. Denton) would now refer. He did not propose to touch at all the question as to whether the land at Keythorpe was effectually drained, as far as the mere removal of water went. He did not presume to deny that, for water would run quickly off land with a rapid slope, even with surface gutters, but this he did not regard as answering all the objects of draining. Lord Berners had probably got rid of the water too quickly by his shallow drains, and had lost all the benefit to be derived from air and water passing through an adequate depth of soil. With respect to cost, some evidence was afforded by the plan which Lord Berners laid before a committee of the House of Lords last Session, and which had been appended to the evidence taken before that committee, as a specimen of the description of plan which should accompany all works of drainage, and for that purpose it was unexceptionable. But in the margin his lordship stated that the "cost of draining" 46 acres of land was £79 19s. 7½d.; and this was put in, indirectly, as evidence of the cheapness of the Keythorpe system. Now he (Mr. Denton) found that at least one-tenth of the land was drained only eighteen inches deep, and when this was objected to the other evening it was stated that the drains were laid in the furrows, and that a sufficient depth was obtained by throwing the ridges into those furrows, and thus gaining a uniform surface. This might be very good as an act of after-treatment of any drained land, but if it was positively necessary, to overcome the evil of draining 18 inches deep, the cost of doing it should be added to the cost of draining; but this item was omitted. Then, again, seventy-six loads of stone were charged for at a cost of £3 10s.,—he presumed as the cost of material.

Mr. Trimmer—That is collecting the stones out of the drain, for which the men were paid extra.

Mr. Denton—That might be so, but where was the material used for the drains, if this 70s. did not represent its cost. If stones were used and a shilling represented the cost of collecting, where was the cost of breaking them to the proper size? Where was the cost of haulage? Where was the cost of superintendence? All these were items which must be paid for, and which were entirely omitted, so that in fact it was patent on the face of this Parliamentary plan, that the cost of £79 19s. 7½d. represented simply the operation of cutting and the mere collection of stones.

Mr. Trimmer—The men were paid a certain price for cutting the drains, and extra for sorting the stones.

Mr. Denton—Just so. He had said enough to draw attention to this paper, which, when regard was had to the character of the work, he pledged himself could not fail to disabuse the public mind on the score of cheapness. For one moment let us go into the question of the subterranean furrows. They were described by Mr. Trimmer as the minor drains of his system, by which water would flow down into certain transverse pipe drains; but, as he had just said, Lord Berners excused the 18-inch drains, on the ground that they were laid in the surface furrows. How were we to reconcile these two facts? Was it possible, by some strange coincidence, that the surface furrows adopted by his lordship as the course of his drains, should exactly accord with the drains prescribed by Mr. Trimmer as necessary to draw the water out of the subterranean furrows, or was it not more likely that the surface furrows would agree in their course with the subterranean furrows. An answer was wanted to these questions. Unfortunately, the public mind had been distracted from the main question of permanent drainage—its results and progress—by the proposition of Lord Berners setting forth the cheapness of his system, and the explanation of Mr. Trimmer giving a scientific bearing to it. He said distracted, because we had not got at the real cost nor all the facts of the case, and which we must have before the Keythorpe system could be generally entertained. Mr. Bullock Webster had alluded to his having stated that it required the drains in heavy clay lands to be placed as near to each other whether they were deep or shallow. He had stated that opinion rather more positively perhaps than he ought, but at the same time he must repeat, that his experience led him to the conviction, that in decided clay soils—homogeneous clay soils—the theory applicable to the more porous lands, that was that depth might govern distance, did not hold good. He could not but repea also, that with regard to the prevailing mode of carrying out works of drainage, we adhered much too closely to the parallelism of drains, and that, undoubtedly, different descriptions of soil had been drained upon too uniform a system. There was another point upon which he thought we were much in error. He referred to the disregard that was manifested to the influence of hydrostatic pressure. We did not sufficiently attend to the fact, that water taken in at a higher level finds its way out through porous strata at a lower level, and with such force as to overcome the gravitation due to drains which would otherwise be effectual. He was desirous to make himself understood upon this point, because he considered that it was an essential element in securing successful drainage. As pressure of water was always due to height, and not to quantity, we ought to have regard to the source from which the water, finding its way out at the hill sides, flowed. Any person who had but a faint knowledge of geology would be able to follow his remarks. We might frequently observe that water falling on the tops of the hills, found its way through the soil, and burst out at the sides, often drowning the lowest lands. Now, he knew from frequent intercourse with landowners and occupiers, that the lands first selected by them to be drained were those which exhibited the greatest amount of wetness, and he had known much discontent follow efforts of draining, because the hill-side lands occasionally showed wetness, and the lowest lands were frequently but slightly benefited. The cause was manifest. The water which had travelled through the porous soil to its lowest vent rose to the surface by those pores and interstices of the soil which were nearest and freest, to the disregard of any drains at a greater distance, and thus the objectionable wet spots in the hill-side lands occasionally occuring in drained land. The lowest lands were even more affected still, for they not only had their own quantum of water to bear, but they received the surplusage of the hills, and until these hills were drained no number of drains, however closely placed, would effectually drain the lowest lands. The remedy was in such a combined system of operations — he did not mean uniform parallel drainage—that the pressure from above should be removed at the same time that the lower lands were being drained. With regard to outfalls, which was the last subject to which he should allude, he was happy to say that he believed there was some prospect of an Outfall Bill being introduced into Parliament during the ensuing session. We were, in truth, approaching the time when the matter must receive attention, for although the quantity of land drained was small in comparison to that which remained to be drained, the water which was discharged by the drainage already effected found its way so rapidly to the outfalls, that the consequences were becoming more and more injurious every day. The millers were now suffering from two causes. At times of excess after a considerable fall of rain, and when the miller was injuriously overloaded, the excess was increased by the rapidity with which the under drains discharged themselves, and as the quantity of water thus discharged must necessarily lessen the subsequent supply, the period of drought was advanced in a corresponding degree. As the millers already saw this, and were anticipating increasing losses, they would join in finding a substitute for water-power upon fair terms. Although steps should be taken before the evils accumulated too much, it was obvious that every year's progress would make the miller less anxious to retain the water landowners were gradually riding themselves of; and thus we might hope that the millers would think it their true policy to abstain from opposing the passing of a proper Outfall Bill.

The **Chairman**, in summing up the remarks, stated that although practically he could not lay claim to that thorough knowledge of the important subject under discussion evinced by those gentlemen who had spoken on this and the former meeting, yet theoretically he had on frequent occasions been obliged to investigate closely the principles and practice of drainage, especially some years ago, as one of the editors of the *Farmers' Encyclopædia*, and subsequently in different agricultural periodicals with which he was connected. The great importance of the subject, whether in a national or individual point of view, could scarcely be overrated, and the deep interest taken in thoroughly ventilating the question was well evidenced by the large attendance of agriculturists when Mr. Denton's paper was read. Although they were less fortunate in their audience on this evening, owing to the farmers and others attending the Smithfield Cattle Show having returned to their several districts, yet it was clear that there were many who took a deep interest in listening to the views of those competent to give information, or they would not have quitted their comfortable firesides on a severe winter evening like this, to attend a discussion on drainage. So many vital interests were identified with the correct practice and principles of drainage, and its general adoption in an island like this was so necessary, since much of the land without drainage would be perfectly worthless, that the more generally the subject was discussed the better. It was quite possible by due attention to the nature of the soil, by a proper application of manures, and by a judicious course of cropping, to render ourselves perfectly independent of foreign grain supplies, but this was of course a matter of expense, as to the cost at which food could be raised for our population. It had, however, been shown that drainage, properly and systematically conducted, although seemingly alarmingly expensive at first, was in its ultimate results highly remunerative for the outlay. If the exceptional instance mentioned by one of the speakers, of seven quarters to the acre, could be made the average produce, instead of three or four quarters, as at present, our wheat crop would thus be doubled, and we should have enough and to spare, without drawing upon America or the Black Sea provinces. There were other considerations connected with drainage, besides increasing the fertility of the soil, and these were, improving the health of localities by reclaiming swamps, diverting the superabundant waters into proper channels for irrigation, for the supply of mill-streams, and thus furnishing adequate water power for keeping up canal navigation, river-channels, springs, and reservoirs, for the supply of towns. Much valuable information, from many practical and experienced men had been elicited by means of Mr. Denton's paper, and the weight of evidence certainly corroborated the value and utility of deep drains as enforced by him. Several very useful suggestions had also been thrown out which merited attention; especially the more general adoption of plans of the drains on an estate, and the entrusting of the works only to skilled practical engineers, so as to leave the farmer at liberty to attend to his husbandry pursuits, without meddling with the planning or management of the drainage. Not the least important of the recommendations in the communications read that evening was that made by Mr. Bazalgette, of carefully-kept registers of the rainfall in different localities. Without some general knowledge of the quantity of water received on the soil, the mean annual and monthly averages, and the number of days on which rain fell, little could be done to keep the land clear of water, or to regulate the drains and the outfall. Rain gauges were much too seldom kept in the agricultural districts. This was a matter which he (the chairman) had recently pressed upon public attention in a paper which he read at the last meeting of the British Association, "On the Rainfall of various Countries," wherein he stated, "We are as yet sadly deficient in accumulated facts from various districts which shall guide us to a knowledge of the mean average fall of rain in certain periods, the proportionate evaporation, and the alternation of wet and dry seasons. If we could obtain, from a long series of observations in various localities, any data to guide us in arriving at approximative estimates of the fall of rain, these would prove of great interest to the agriculturist, the engineer, and the physician." Although we were considering this matter specially as it regarded the improvement of the lands of our own island, there was no doubt the benefits would ultimately extend further. Many continental countries took their tone from us, and watched with interest our agricultural improvements, availing themselves of those which they found applicable to their special circumstances and localities. So also with our colonies. There were many low lying districts in Demerara, in India, and other quarters, where drainage on scientific principles might be beneficially carried out for the advantageous cultivation of staple crops, and the improvement of the health of the district. There was another portion of the subject which had been touched upon requiring early attention in the legislature, namely, the necessity of some enactment for enforcing uniformity of action—for harmonizing and connecting the drainage plans carried out, so as to prevent clashing, and for dealing with many private rights affected by the adoption of an effective and general system of drainage. In the name of the Society he had now to present their cordial thanks to Mr. Denton, a gentleman whom personally he had long known, and whose scientific researches and practical operations he highly appreciated, for the elaborate and very valuable paper with which he had favoured the members.

The Secretary announced that there would be an *Extra*-Ordinary Meeting on the evening of Wednesday, January the 9th, when the second part of Mr. J. Kenyon Blackwell's paper, on "The Present Position of the Iron Industry of Great Britain, with reference to that of other Countries," will be read.

Particulars of the arrangements already made for the following meetings, will be found in the Society's advertisement on the front page.

ON MACHINES AND PROCESSES FOR PREPARING FIBRES.

By P. L. Simmonds.

As the fibres of Indian plants are now attracting considerable attention among European manufacturers, it may be of some use to publish the results of experiments that have been tried to prepare them for the English market, and to turn them to practical account in various quarters. I therefore avail myself of the practical instructions published for local use by Dr. Hunter, of Madras, and various information furnished me from time to time by my colonial correspondents in the West Indies, at Singapore, in New Zealand, and Central America.

The demand for fibrous substances as substitutes for flax, hemp, silk, cotton, and hair, is becoming so great, that the market cannot be supplied with a sufficiency of these raw materials to keep our large manufactories in full operation, and India and the Colonies are now looked to as the quarters whence these supplies must be furnished.

Flax, hemp, and cotton are the substances most urgently called for; and as the two former are wasted in large quantities in many parts of India, and are hardly ever prepared with sufficient care to make them profitable articles of export, a description of the simplest and most economical methods of cleaning them may prove of interest to the public; and as numerous requests have been made for detailed accounts of these experiments, it may be as well to give them extended publicity.

The usual process followed in India, for preparing the fibres of succulent fleshy plants, consists in cutting the plants, when in full vigour, and burying them in wet sand on the banks of a running stream, or in mud at the edge of a tank, and leaving them there to soak and rot for one, two, or three weeks, according to the temperature of the weather. The plant is then taken out and spread in the sun to dry, after which it is stacked, or put up in heaps, and covered with a matting of dry leaves to shelter it from wind or rain. It is afterwards beat with heavy sticks upon the dry hard ground, and well rubbed between the hands, to separate chaff and dust. Another method is to take the soaked plant in bundles and beat out the pulp and impurities on a flat stone, at the edge of the tank or river, in the same way as the washerman washes clothes.

The fibres of the marool, or *Sansevíera Zeylanica*, are prepared by scraping and washing in fresh water soon after the plant is cut. The fibres of the Yercum, or *Calotropis gigantea*, are separated by exposing to the sun, for three days, the fresh cut stalks of the plant stripped of the leaves. The bark is then peeled off, and the fibres are picked out with the finger and thumb. The two last processes yield fibres of good quality, but in too small quantity to prove remunerative, except as an employment for children. The system of cleaning fibres by rotting is not suited to warm climates, as putrefaction sets in almost as soon as fermentation; and while one part of a heap of leaves or stalks is beginning to ferment, other parts are brown and stained from putridity, while the central parts remain fresh and unaltered. To preserve the colour and strength of fibres, all that is necessary is to separate the pulp, bark, or wood, as soon as possible, and by the least complicated process. The pulp, or juices of plants usually contain mucilage, starch, or gum, which begin to ferment within 24 hours after the plant is cut; and if they be left in water during warm weather, fermentation is completed within two or three days. In cold climates it takes from three to four weeks to run its course. The result of fermentation being completed, is that the sap becomes acid and destroys the strength of the fibre. This is followed by putrefaction which stains the fibre, and makes it brownish, and brittle, like chaff.

If the plant be exposed to the sun for a day or two after being cut, the sap dries, and the colouring matter stains the fibre, which cannot then be easily separated from the bark, spiral cells, or woody fibre. In some plants this discoloration is green, in others brownish, or dusky yellow, which cannot be removed by bleaching, as it is a species of natural tanning which occurs in the plant. Such fibres always remain harsh, stiff, and woody, with a tendency to snap on a sudden strain. The plantain fibre is the most liable to this defect, from the sap containing a good deal of tannin, which can only be removed by quickly expressing the juice, and only cutting as much of the plant as can be cleaned in one day.

The general rules for cleaning the fibres of pulpy plants are, first to bruise or crush the plant, keeping the juice for a coarse kind of vinegar, required in another process. The common native sugar-cane mill, with two perpendicular rollers, a long lever handle, and a channel to convey the juice into some convenient vessel, answers this purpose very well; the cost of such a mill is about ten rupees (£1). Those who cannot afford to purchase or erect one, but who can command plenty of Cooly labour, will require to provide a few long planks and heavy wooden mallets, to beat the plant till all the pulp is loosened.

When it is in a pulpy mass, it must be taken at both ends, and twisted opposite ways to squeeze out the sap. It is then to be well washed in plenty of water, untwisted and scraped, in small handfuls at a time, on the board, with an old blunt table-knife, or a long piece of hoop-iron fastened into a straight handle. When all impurities are removed, the fibres may be soaked for an hour or two in clean water, and then hung up in the shade to dry. Exposure to the sun at first is apt to discolour them. By this simple process, fibres of great strength, of a silky appearance, and of a good colour, can readily be prepared. The scrapings must be well washed and set aside in the shade to dry as tow for packing, or as material for making paper.

The Indian plants, to the cleaning of which this process is applicable, are those of a fleshy or pulpy nature, as the aloe, agave, sanseviera, and plantain genera, of which there are so many species.

On the Cleaning of Plants having Bark and Woody Fibres.

Many of the Indian cordage plants are of this kind; and the native process of cleaning them is very similar to that followed in cleaning fleshy and pulpy plants, viz., by burying in sand or mud at the edge of a tank, or in a river, and leaving them to rot. There is this difference, however, that the plants are steeped longer, and are never exposed to the sun to dry, or stacked and covered with matting, to be cleaned by dry beating. If this were done, the woody fibre would get hard and brittle, and would again adhere to the other fibre, which, being partially rotten, would break in the cleaning. To obviate this, the rotted plant is taken up in large handfuls, and beaten on flat stones, first at on end, and then at the other, in the same way as clothes are washed by the washerman. They are next well rubbed and washed, to separate the impurities, and are spread out on the ground to dry. We can hardly wonder that most of the string and rope made from fibres, prepared in this rude coarse way, should be dark in colour, possessed of no strength, and of little value. As a general rule, every day's steeping of a fibre takes from its strength, and imparts more or less colour. To obviate this, woody plants should be first well beaten with a mallet; then the bark should be separated from the stalk, for it is on the inner part of the bark that the fibres for cordage usually occur. When the bark is brought to a pulpy state, it must be well washed in clean water, to remove as much of the sap as possible, for this is the destructive agent, which soon causes putrefaction. The old mode of steeping, or rotting flax plants, is quite abandoned in many districts, as the water was found to be poisonous to cattle and fish, and the neighbourhood where it was carried on became feverish. The same remark has been made in India; and there are many districts where flax is cultivated on account of the linseed, but the plant is burnt and the fibre washed, lest cattle should be poisoned by eating it. In Flanders, where the greatest care is bestowed on the growth of flax, the preparatory crops are barley and rye, with turnips after them, the same year. It is grown the third year of a seven course rotation, or the fifth year of a ten course rotation. It is considered an exhausting crop, and the land is richly manured, and dressed with liquid manure; the seed is then sown abundantly in the proportion of 160lbs. to the acre; a slight harrowing and the passing of a light roller over the ground ensuring quick germination. If the quality of the fibre be the chief object, the seed is sown thickly; the plants come up in a crowded manner, and are tall and of delicate growth. If the seed be the chief object, then wide sowing and exposure to the sun is the best; the stalks becoming strong and branched with coarse fibre. The weeding of the flax forms a considerable item in the expense of its cultivation. This is performed when the plant is a few inches high; it is done by hoeing, or by women and children, who with coarse cloths around their knees, creep along on all fours, which injures the young plants less than walking upon them. The weeders also take care to face the wind, that the tender flax, bent down by their weight may be assisted in rising again. When weeding is too long delayed, the plants are bruised and injured, and cannot recover their erect position. Some tall and slender varieties are supported by stakes, lines, and cords, about one foot eight inches from the ground; or ropes are tied to stakes lengthways and crossways, so as to form a network all over the field. The time of pulling the crop depends upon the season, and the intention of the grower. If fine fibre be his object, he pulls the flax rather green; but if the quality of the seed be considered, a longer time is given before pulling. The latter object is generally attained when two-thirds of the stalk have turned yellow, and when the seeds have changed from their fluid state; for they ripen sufficiently after the flax is pulled, if not separated from the stalk. Taking up the crop in a wet state is avoided if possible. The pulling is carefully done by small handfuls at a time, which are laid regularly across each other to dry, and are afterwards collected in larger bundles, the root ends on the ground, and the seed ends tied lightly together, as sheaves of grain in the harvest-field. The practice of cultivators differs very much as to the after-processes. Some disregard the seed and commence steeping the flax at once; some carry it as soon as it is dry under a shed, and take off the capsules by a process called rippling; others house the flax as soon as it is dry, allowing the seed to remain on, and deferring the processes of rippling and steeping till the following season.

Memorandum Relative to the Plantain Fibre.

Several modes have been recommended for the preparation of this fibre.

First—Beating, washing, and drying.

Second—Simply cutting and drying.

Third—Scraping.

If we look at the structure of the plant itself, we shall be able to form an estimate of these processes.

The plant is composed of at least two very visible rows of cells, an inner and an outer, along its whole extent upwards and downwards, and through every layer, there being several layers.

The cells are formed of fibre for "uprights," and "sills," and "plates," and tissue as it were for "plastering;" the former useful for ropes, drills, etc., the latter for paper.

Of the processes above, the last is the only one that produces fibre in its pure state; but whether we scrape from the inner or outer surface, we must lose all the tissue, and probably more than half the fibre.

The first process will produce the material of the plantain stalk in a fit state for shipment with partially clear fibre, but nearly all the tissue will be lost. The washing also should be simple rinsing, as the allowing the tissue to remain in water tends to discolour it greatly.

The second process I imagine would be very slow, in consequence of the abundant water of the stalks. I apprehend also the discoloration which would ensue from this process, would render the material all but unfit for market, except at a very low rate.

It seems desirable that three or four objects should be kept in view in any process.

First—Saving of the tissue for paper.

Second—Preserving that tissue of an agreeable appearance.

Third—Ultimate freeing the fibre from the tissue.

Fourth—Preserving all the fibre.

And with relation to these, the process and mechanical arrangement are to be considered.

By no process of the hand can clean fibre be profitably procured. For this, resort must be had to machinery.

The material for fibre—fibrous material, as we shall term it—that is to say, the stalk after it has undergone process without separation of the tissue or pulp, may be prepared either by hand or machine—the latter being of course the most economical.

Squeezing, rinsing, partial separation, or "teazing" with the hand after being hung up on rails of bamboo, or other cheap article, and rapid drying, may be recommended as a simple and efficacious process for obtaining the fibrous material in a favourable state, and with the several objects referred to in view.

Machinery for performing this, and effecting the final separation of the fibre from the pulp or tissue must be a desideratum. In the absence of such machinery parties can hope to prepare only advantageously the fibrous material, and that by hand.

It has been supposed that boiling of the material would render the separation of the fibre at a future time more easy—but this seems unnecessary. Simple saturation in water for some few hours renders it fit for further process.

At a recent meeting of the Society of Arts, Jamaica, Mr. G. W. W. Clarke exhibited a machine he had constructed for preparing fibre, with the improvements made in it since a previous exhibition.

The machine was worked in the presence of the meeting, and produced excellent specimens of fibres from the Spanish and Jamaica dagger plants.

Mr. Brown, the secretary of the Society of Industry, at Hanover, Jamaica, has also invented a machine for procuring the fibre from the plantain stalks. It is a large cylinder, revolving on an axis under large knives, so placed as to clean the fibre completely by scraping.

I have had repeated inquiries respecting the cheap machine of Mr. Burke, to which I made allusion in my lecture last year. In reply to these inquiries from Ceylon, from the Cape, from Algeria, and other quarters, I may give the following information:—

(*Extract of a Letter from Mr. Burke.*)

"I have been delayed somewhat in getting the machine[8] out, but very soon shall be able to supply you.

"As the evidence of the importance and value of the invention has accumulated, so it has behoved me to be more careful, that I may not lose at least a portion of the profit by bringing it out in a state that might enable some other to top it by an improvement. I have therefore been closely engaged with the machinist who is just fit for the work, in a course of experiments, trying different adjustments, &c., &c., having had over large supplies of stems, aloe leaves, &c., per Royal Mail steamer. The results are very satisfactory, showing I was right at first, and giving us confidence that it will be so perfect as not to be capable of any improvement not covered by my patent. I have also fitted a feeding apparatus to it, which adds to its value, and am engaged completing a small machine to use up the inner part of the stem—the top of the plant where the leaves branch out, and the leaf stalks, all full of fibre fit for paper; for this article I can now make large contracts. I am also preparing a press to put up fibre and paper stuff in proper bales for shipment, and suitable apparatus to work several machines by animal power, where desired. I have also arranged for the extensive manufacture of the machines, so as to meet all demands when we do start, so that the means to prepare all the material ready for shipment in the tropics shall be obtainable when desired.

"The matter has assumed so much importance as to justify and call for these arrangements. That there is a market at good prices for our W. I. fibre is now clear beyond a doubt; the evidence has already accumulated to make it certain, and in due time it will be published."

A late Antigua paper also states:—

"We understand that the machine invented by the Honourable Francis Burke, of Montserrat, for cleaning and preparing the plantain, aloe, and snake-grass fibres for the hands of the manufacturer, has in every way proved highly successful, and that he has greatly improved it in England. The invention was subjected to the most rigid experimental tests by practical and scientific men who have expressed their unqualified approval of the certainty and facility with which the machine operates; and the perfect manner in which it cleans the fibre without injuring, or in any way impairing its strength. The improvements effected diminish the amount of manual labour, which was even in the first instance very inconsiderable, and renders it capable of preparing any quantity of fibre with very little manual labour. It is said to be fully qualified to meet the wants of the colonies. Several machines are on their way to Montserrat, and others will follow to Demerara, where a large premium for an improved invention of the kind has been offered by the legislature. It is probable one will be set to work in Barbuda, for preparing for shipment the aloe fibre in that island. As Mr. Burke is associated with several large capitalists in England who take an interest in the West Indies, there is every chance of the invention having a fair trial and being brought into active operation in all the colonies where native fibre is to be found in any considerable quantity. We learn Mr. Burke may shortly be expected in Antigua."

I understand, also, that Mr. Sharp, who has certainly applied himself most indefatigably to the subject for the last year or two, has made some extensive additional arrangements in the machinery patented by him last year. These improvements are stated to be so important and effective, that each machine, upon the new principle, will produce a *minimum* quantity of 10 or 12 cwt. of fibre a-day, the fibre of a large plantain being separated in a minute or a minute and a-quarter, throughout the day; and I am aware he has offered to prove that a full-sized plantain-tree, of 10 or 12 feet in height and 6 or 8 inches in diameter, shall be actually growing, and its fibres obtained, and put into a marketable state, all within a space of 15 minutes. If such rapid means of extraction can be really carried out upon a large scale in practice, the *desideratum* will be reached of effectually meeting the demand for fibrous matter.

The following is an account of the machinery employed by Dr. Stewart West, of Jamaica, who obtained the premium some years ago offered for the best specimen of plantain fibre.

"In order to fulfil the intentions of the honourable House of Assembly, I propose to myself to find out the most simple and expeditious process possible for manufacturing hemp from the plantain tree, that the general adoption of it might not be prevented by complex machinery, or tedious and difficult manipulation.

"I have now to give the result of my inquiries, and have to describe such a simple and easy process, as will enable any person to set on foot a manufacture of hemp, without much trouble or expense. The instrument I have employed is so simple, that a carpenter may make it in half-an-hour, and the whole process is so expeditious, that the hemp may be rendered fit for sale in a few hours after the trees are cut down: I mean the *undressed* hemp; for to dress it with a heckle, unless it were likewise spun and wove in the country, would be quite foreign to the purpose. The process of heckling is by no means so simple as it appears to be: and I can truly affirm that if a person, not bred to the business, attempt to heckle flax and hemp, he will convert the greater part of it into tow; besides, different modes of dressing are necessary, according to the manufacture to which the hemp is to be applied. That part of the process, therefore, can be executed better, and to much greater advantage, in Britain. But if the instrument be in good order, and proper attention be paid to the manufacture, the hemp will be rendered so clean as, in a great measure, to supersede the use of the heckle especially for cordage.

"Though the filaments of the plantain-tree are naturally large, yet they are divisible, and may, therefore, by dressing, be adapted to the manufacture of the finest fabrics, perhaps, to which flax and cotton can be applied. The division of the filaments, however, would be prejudicial in the manufacture of cordage; for, it appears, from an experiment of Count Rumford, that the agglutination of the fibres greatly increases their strength.

"DIRECTIONS FOR MAKING THE CRAMP.—Take a plank, six feet long, one foot wide, and two inches thick, set one end two feet deep in the ground, and apply a brace before to keep it steady; cut a notch on the top, six inches deep, and eight inches wide; notch the two uprights, half-an-inch wide, to admit the jaws, which must be made of hard wood, the lower one twelve, the upper twenty, inches long; the lower is fixed, the upper is moveable on a pin at one end, and has a weight suspended at the other, which may be increased or diminished at pleasure. The upright, in which the upper jaw turns on the pin, may have a mortice, five inches long, in place of a notch, and two inches may be cut off from the other upright. The jaws are half an inch thick, and two inches wide, brought to an edge where they meet, which must be slightly serrated. If the jaws are made of steel, a quarter of an inch in thickness will be sufficient."

From plants of a ligneous nature, fibre may be obtained, without machinery, by macerating the shoots until the cuticle or outer bark disadheres fairly from the epidermis or true bark; the latter will then separate readily from the ligneous part, and requires but little labour or knowledge to wash, dry, and pack the fibre for market. For the plantain, penguin (*Bromelia pinguin*), and all similar herbaceous plants, machinery is absolutely necessary to separate and clean the fibre advantageously.

The preparation of the pine-apple fibre is exceedingly simple. If a leaf of this plant be examined, it will be found to consist of an assemblage of fibres running parallel from one extremity of the leaf to the other, imbedded in the soft pabulum. All the process necessary is to pass the leaf under a "tilt hammer," the rapid action of which in a few seconds completely crushes it, without in the slightest degree injuring the fibre, which remains in a large skein, and then requires to be rinsed out in soft water to cleanse it from its impurities, and to be afterwards dried in the shade. So simple and so rapid is the process, that a leaf, in a quarter of an hour after being cut from the plant, may be in a state fit for the purposes of the manufacturer, as a glossy white fibre, with its strength unimpaired by any process of maceration, which by inducing partial putrefaction, not only materially injures the strength of the flax, but also renders it of a dingy colour.

In Singapore, where there are several thousand acres covered with this fruit, the process of extracting and bleaching the fibres is exceedingly simple. The first step is to remove the fleshy or succulent side of the leaf. A Chinese astride on a narrow stool, extends on it, in front of him, a pine-apple leaf, one end of which is kept firm by being placed beneath a small bundle of cloth on which he sits. He then, with a kind of two-handled plane made of bamboo, removes the succulent matter. Another man receives the leaves as they are planed, and with his thumb-nail loosens and gathers the fibres about the middle of the leaf, which enables him by one effort to detach the whole of them from the outer skin. The fibres are next steeped in water for some time, after which they are washed, in order to free them from the matter that still adheres and binds them together. They are now laid out to dry and bleach under frames of split bamboo. The process of steeping, washing, and exposing to the sun is repeated for some days until the fibres are considered to be properly bleached. Without further preparation they are sent into the town for exportation to China.

Mr. Underwood, of Madras, has recently invented two simple and effective machines for cleaning fibre, one a cheap modification of the brake, and the other a grooved cylinder press, covered with sheet iron, by which the juice is removed, and the fibre afterwards becomes soft, pliant, and fit for weaving. It is probable that this thick, viscid, milky juice gives to the aloe and other fibres its tendency to rot when much exposed to moisture. Major Maitland is also reported to have invented a fibre-cleaning machine, which is incidently mentioned by the jury of the Madras Local Exhibition, but I have met with no description of it.

Many attempts have been made from time to time to construct a suitable machine for cleaning the New Zealand flax, but comparatively small success has yet attended these efforts. The Baron De Thierry and Mr. Alzdorf, of Auckland, Mr. Nathas, of Nelson, and Mr. Hill, of Sidney, all professed to have discovered machines and processes of great value, but they seem to have died away. The successful employment of efficient machinery would furnish the New Zealand flax dressers with almost inexhaustible supplies of a material admirally adapted for the manufacture of not only canvas and cordage, but of linen, cambric, paper, and other textile fabrics.

A few years ago, favourable mention was made at Auckland, of a machine, the invention of Mr. Whytlaw, for the purpose of separating the fibre from the pulpy cuticle of the *Phormium tenax*. Hitherto, notwithstanding the industry and ingenuity that has been directed towards the desired end, the endeavour to bring this flax to market in a cleaner and more commercial shape than that which the natives have been in the habit of doing, has proved, for all practical purposes, an absolute failure. Mr. Whytlaw, it was thought, had laid the foundation of a discovery which might be improved upon, and be the eventual means of creating a very large demand for the New Zealand flax.

The natives, and, we believe, every previous experimentalist, in decorticating the flax leaf, applied their machinery so as to act longitudinally on the leaf. After much consideration, Mr. Whytlaw felt convinced that this principle was erroneous, and that the leaf should be subjected to a transverse action. In this belief he was subsequently more fully confirmed from noticing that wherever the growing flax had been bitten by cattle, that there the fibres and filaments of the flax were effectually separated and exposed, and this, in the projector's opinion, because of the circular sort of action of the tongue and jaw of the ox.

Armed with the suggestion thus furnished, Mr. Whytlaw proceeded to reduce his theory to practice. His first machine was made of the hard woods of the colony, and by its assistance he was enabled to dress a sufficiency of the green leaf for transmission to the Great Exhibition in London. But the wooden grooves of the machine were found to operate ineffectively, owing to their becoming easily clogged. They were, therefore, replaced by others of brass.

The manner of divesting the leaf of its cuticle is simple, and notwithstanding the flax which was operated upon was not of that kind which the natives would clean, still the facility with which the pulpy matter is got rid of, and the extreme regularity with which the fibre is set free, were most satisfactorily demonstrated. The leaf is passed longitudinally between fluted surfaces, the one surface acting upon the other diagonally, and thereby completely separating the various fibres—no loss of material, as in the native process of scraping ensues, nor are the fibres liable to kink or become twisted together, after the pig-tail fashion; on the contrary, they hang together smoothly and regularly, and the only further process preparatory to packing and shipping is the washing and drying of the commodity obtained.

Although there had been much chemical experimentalizing in the colony to discover the means of freeing the flax from the gum with which it is incorporated, the scientific persons in Scotland with whom Mr. Whytlaw has been in communication strongly advise no such attempts being made. "Send us the fibre," say they; "we have discovered the chemical solvents which you are in search of, and we can apply them much more effectually and economically than you."

The chief drawback to Mr. Whytlaw's machine lies in the necessity of supplying the feeders *manually*, and these with but a single leaf each at a time. This, if an insurmountable obstacle, would tend to augment the cost of production, and contract the amount of supply, but as we consider that the principle of the operation is almost all that has hitherto been discovered, there can be no question that mechanical means of feeding the machine will ere long suggest themselves.

I have not heard whether this machine has come into general use and been found practically efficient for the purposes intended or not.

Proceedings of Institutions.

Chelmsford.—On Wednesday, the 5th inst., the members of the Literary and Mechanics' Institution were favoured with a lecture from Mr. John Bennett, F.R.A.S., on "The Birth, Parentage, and Education of a Watch;" a subject apparently dry in itself, yet, by tact and judgment, rendered highly interesting by the lecturer. Mr. Bennett commenced by alluding to the sun-dial of the ancients, and then progressed up to the pendulum and wheelwork of Galileo. The difficulties encountered in the correct measurement of time by the alternate expansion and contraction of the metals, and the different modes practised to counteract this, finally resulting in the elegant and accurate contrivance of the Mercury pendulum of the present time, were simply and effectively told. As an instance of the perfection of the modern astronomical clock, it was stated that a variation of *one beat* in six days would be sufficient to occasion the rejection of such instrument for the purposes required. The adaptation of the larger machine, to the size convenient to be carried about the person with comfort—the difficulties met with, and how surmounted, one by one, formed an interesting feature of the lecture. The excellence of English manufacture was considered to be unsurpassed, and it was stated that all improvements and discoveries of any moment, in time-keepers, since the days of Galileo, have been made by Englishmen. At the conclusion of the lecture, a vote of thanks was passed to Mr. Bennett, on the motion of the chairman, Major Skinner, R.A.

Hereford.—The first *soirée* of the present session of the Literary and Antiquarian Society was held on Tuesday evening, the 4th inst. Mr. Jelinger C. Symons, president of the Society, occupied the chair. The Chairman having briefly opened the proceedings, introduced the Rev. John Emeris, of Gloucester, who read a lively and amusing sketch of "Public Men and Public Affairs in England in 1755." Beginning with the King, George I., then in the 72nd year of his age and the 29th of his reign, the lecturer first remarked on his personal appearance and manners, and then spoke of his bravery, which was undisputed. The first memorable action of his life was to serve under Marlborough, at Oudenarde, in 1708. Thirty-five years later, when 60 years of age, and after he had been long on the throne, he took part in the battle of Dettingen. These fighting days he is fond of recollecting. He is very methodical; rises early; dines early, and then goes to bed for an hour. He spends the evenings in his daughters' apartments, where, with a select company, he plays at cards. His actions are not always kingly, and people about the Court says he is penurious. He is Elector of Hanover, and is fonder of that country than of all Great Britain and Ireland put together. Within one week after the prorogation of Parliament, he leaves London for Hanover, and spends five months there. During his absence, the direction of affairs is entrusted to twelve Lord Justices. The first was his only surviving son William, Duke of Cumberland, afterwards known as the popular "Old King." The rest are for the most part distinguished by wealth and the possession of office, but not by any brilliant talents. Two, however, must be excepted. One of these is the Lord Chancellor, Philip Yorke, Earl of Hardwicke, who starting in life as the son of a Devon attorney, was made Solicitor-General six years after he was called to the bar, when only thirty years of age. He has now the custody of the great seal, which he has held for eighteen years, and a twelve month ago he was created an Earl. Of his judgments only three were called in question, and each of these was confirmed on an appeal by the Upper House. Amongst the members of the Cabinet is Thomas Pelham, Duke of Newcastle, First Lord of the Treasury, Prime Minister to the King, and leader of the House of Lords. His only genius is for deception and intrigue. After briefly sketching the Earl of Chesterfield, the lecturer passed on to consider the distinguished Commoners. The leader here is the Right Hon. Henry Fox, who became on the 14th of last month Secretary of State, and Ministerial leader of the House of Commons. From unpopular Henry Fox, the lecturer passed to brilliant William Pitt, now forty-seven years of age, during the last twenty of which he has been M.P., and for the last nine Paymaster of the Forces. In this capacity he was consulted by Mr. Legge, then Chancellor of the Exchequer, as to some subsidiary treaties which the king had made when on the Continent, with the Landgrave of Hesse and the Empress of all the Russias. Pitt is resolute against the payment, and about a fortnight ago was dismissed from his office. Popular feeling, however, is with him, and next year he must be called back to take the most leading part in the king's Council. During the Session, the Lords Spiritual and Temporal, as well as the Knights of the Shires and Burgesses in Parliament assembled, passed no act for which, as permanently touching our home interests, they deserve any thanks. The lecturer concluded by reading an account of the great earthquake at Lisbon.—After tea, the Chairman called on the Ven. Archdeacon Freer to deliver his lecture on "Ancient Fictile Vases." Few remains of antiquity, he said, had excited more interest than vases, owing to the variety and elegance of their forms, the beauty of the compositions with which they are adorned, and the important instruction which the subjects of those pictures convey. By attentively studying them, the scholar has been enabled to throw much light on the mythology, the history, and the customs of the ancients; the artist has derived high improvement from copying beautiful designs; and the manufacturer, by imitating their forms, has materially improved the shapes of many of those vessels which minister to the comforts and elegancies of life. Vases such as those before the meeting were long called Etruscan, from having been discovered first in Etruria (now Tuscany); but M. Wincklemann showed the absurdity of calling by that name articles found so plentifully in various parts of Italy, as well as in Sicily and Greece. The more proper denomination is certainly "Greek," but looking at the fact that these vases had been found in other countries than Greece, M. Visconti had suggested the name of Græco-Italic or Italo-Greek. Passing to the collection before them, the lecturer observed that they ranged in date from the 5th or 6th to the 2nd century before the Christian era. Vases were employed for a variety of purposes, both domestic and sacred. In the temples, some were used to contain the lustral water for purification; others to receive the blood of the victim; and others to hold the consecrated wine to be poured on its devoted head. Those in the form of bottles with long necks seem to have contained the oil to feed the lamps which burned before the shrines of the gods; while others served for the presentation of the first fruits of the harvest, or of the vine, or of flowers, by the grateful worshippers. Many were to be seen in the Lariaries, or domestic chapels; and others were used in the Eleusinian mysteries, were carried in public processions, were given at prizes in races and gymnastic sports, were customary presents to friends, to a mother on the *dekate*, or tenth day, when the child was named, or to a youth upon his leaving off the dress of a child, and assuming that of a man. They were also used in the baths, at feasts, and for decorations in halls or gardens. Their preservation in such numbers is due to their being deposited in tombs. The figures upon vases or other vessels are generally of a reddish colour, sometimes relieved by white and black, upon a dark or black ground; but in some of the oldest vases the figures themselves are black, and the ground yellowish red. In those of the latest, blue, white, and other colours are used, the ornaments becoming more elaborate and the forms less pure and beautiful. The following, by Monsieur D'Hancaville, which is founded upon the examination of various specimens, seems to have been the manner in which they were made:—"The earth or clay was extremely light and porous, and of a yellowish red colour, when made and dried; but probably previous to undergoing the action of fire, some instrument rather hard, and capable of containing a portion of black liquid pigment of a certain consistency, was employed by the artist in drawing the outline of the figures and composition. * * * * *
The artist then, probably with a brush, laid on a coat of the black close to the outline, of a certain width, and some inferior person filled up the other parts. * * *

They were then done over, perhaps, with a sort of varnish with a reddish tint, with but little polish, some scarcely with any, although the later vases, and those found at Nola, Capua, and Naples have a most perfect and enduring gloss." The lecturer concluded by alluding to the Portland Vase, which cannot, indeed be called "fictile," in the more confined sense of that word, as being formed upon the potter's wheel, but is of glass, and, therefore, blown, though afterwards worked upon the lathe. The lecture was illustrated by a very beautiful and varied collection belonging to the Ven. Archdeacon. The vases were of all sizes, from the large "krater," or cup for holding wine and water at feasts, capable of holding a gallon, and the "amphora," or water-jug of similar capacity, down to the small "lekythos," designed to hold oil for the sepulchral lamp, and the even smaller vase intended to hold perfumes or unguents for the toilet-table. On the proposition of the Very Rev. the Dean of Hereford, the President presented the best thanks of the meeting to Archdeacon Freer for his most able and interesting lecture. The vote having been suitably acknowledged by the Ven. Archdeacon, the meeting broke up.

To Correspondents.

Erratum.—Mr. P. L. Simmonds has pointed out the following typographical error in his letter in the last Number of the *Journal.* Page 75, col. 1, line 44, for *Prussia* read *Persia.*

MEETINGS FOR THE ENSUING WEEK.

Mon. Actuaries, 7.
London Inst., 7., Mr. Charles Cowden Clarke, "On the Genius and Comedies of Molière."
Tues. Pathological, 8, Anniversary.
Wed. London Institution, 3, Mr. Robert Grant, "On Elementary Astronomy."
Pharmaceutical, 8.
Thurs. London Inst., 7, Dr. R. E. Grant, "On the Natural History of Animals."
Photographic, 8.
Fri. Botanical, 8.
Sat. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette December* 21*st*, 1855.]

Dated 6th September, 1855.

2018. Charles Pryse, Birmingham, and Paul Cashmore, West Bromwich—Improvements in repeating fire-arms.

Dated 18th October, 1855.

2336. Samuel Statham, Islington—Improvements in electric telegraph cables.

Dated 13th November, 1855.

2550. Robert Tempest and James Tomlinson, and Richard Hampson, and John Hampson, Rochdale—Improvements in looms for weaving, which improvements are applicable to working the valves of steam-engines.

Dated 19th November, 1855.

2599. Thomas Culpin, 25, Royal-hill, Greenwich—Improved apparatus for regulating the supply and discharge of fluids and gases.
2601. Josiah Pratt, Bath-street, City-road, and Thomas Radcliffe, Shaftesbury-street, Hoxton—Improvements in the manufacture of brushes.
2603. John Silvester, West Bromwich—Improvements in steam guages and safety valves.
2605. John McNichol, Manchester—Improvements in machine or cylinder printing.
2607. Michel Pierre Alexis Gilardeau, 39, Rue de l'Echiquier, Paris,—A new motive power.

Dated 20th November, 1855.

2609. Theodore Schwartz, New York—Improvements in drying, heating, and melting solid and plastic bodies.
2611. George Geyelin, 13, Melville-terrace, Torriano Avenue, Camden-road—Propelling vessels by means of pistons, which he calls anti-friction propellers, to supersede paddle wheels, screws, and all other contrivances at present in use.
2613. Francis Puls, Soho-square—A new electric light and heat.
2615. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in apparatus for preventing horses from running away. (A communication.)
2617. Edward Orange Wildman Whitehouse, Brighton—Improvements in electro-telegraphic apparatus, parts of which are also applicable to other purposes.
2619. David Simpson Price, 2, South Moulton-street, and Edward Chambers Nicholson, 3, Newington-crescent—Improvements in the manufacture of cast steel.
2621. George Senior Tolson, Robert Henry Tolson, and Joseph Senior Tolson, Dalton, Kirkheaton, York, and Thomas Irving, Mold-green, Dalton—Improvements in producing metallic lustre to yarns and fabrics. (A communication.)

Dated 21st November, 1855.

2625. Armand Jean Baptiste Louis de Marcesheau, Paris—Improvements calculated to increase the efficiency or working power of steam engines.
2627. William Munslow and Henry Wallwork, Miles Platting—Improvements in railways.
2629. Thomas Wright Gardener Treeby, 1, Westbourne-terrace Villa, Westbourne-terrace North, Paddington—Improvements in revolving fire-arms.

Dated 22nd November, 1855.

2631. John Roberts, jun., Whitechapel-road—A machine or apparatus for cooling tobacco during the process of manufacture.
2633. Edmund Calvert, and Sidney Ashton Smith, Walton-le-Dale—Improvements applicable to carding engines.
2636. Frederic Lotteri, Bergamo, Lombardy—Obtaining fibre from the bark of trees of the morus family or class, and the application thereof to the manufacture of paper and textile materials, and for other useful purposes.
2637. Charles Tennant Dunlop, Glasgow—Improvements in the manufacture or production of artificial oxide of manganese.
2639. Charles May, Great George-street, and Paul Prince, Derby—Improvements in the manufacture of spikes and trenails.

Dated 28th November, 1855.

2690. James Walker, Leeds—Improvements in the manufacture of textile fabrics.

Dated 1st December, 1855.

2696. Charles Maybury Archer, 3, St. James's-gardens, and Haverstock-hill, Hampstead-road—A new material for the manufacture of paper, and for the production of textile fabrics.
2710. John Gardner, M.D., 51, Mortimer-street, Cavendish-square—A method of treating tea for economising its use and transport.

Dated 4th December, 1855.

2724. Etienne André Napoleon Brécheux, Paris—Improved axle-tree for carriages.
2726. William Foot, Wellington, Somerset—An instrument for moving and stopping trucks and other carriages on railways.
2728. Jean Davoust, Hotel des Invalides, Paris—Improvements in cartridges. (A communication.)
2730. John Marsh, Nottingham—Improvements in the manufacture of looped and piled fabrics.

Dated 5th December, 1855.

2732. John Moffat, Birmingham—Improvements in the manufacture of metallic spoons, forks, and ladles.
2734. William Nunn, 7, Church-street, Hackney—An improved table, washstand, mirror, &c., combined in one piece of furniture.
2736. William Beatson, Rotherham—Improvements in treating borates of lime and magnesia, and a new composition formed therewith, suitable for glazing and other purposes for which borax has been or may be employed.
2738. William Smith, 82, Margaret-street, Cavendish-square—Improvements in apparatus for regulating the supply of air to furnaces.
2740. Alfred Vincent Newton, 66, Chancery-lane—Improvements in apparatus for dressing cloth. (A communication.)

Dated 6th December, 1855.

2744. William Mosley, Salford—Improvements in machinery or apparatus for stretching and finishing woven fabrics.
2746. John Barrow, junior, Manchester—Improved process of manufacturing soda and sulphuric acid.
2748. Thomas Dunn, Glasgow—Improvements in fire-arms.
2750. John Cornes, Swan-lane—Improved mangle or press, parts of which are applicable to rollers employed for pressure purposes generally.
2752. Johannes Neuenschwander, Berne, Switzerland—Improvements in the process of preparing what is called 'Swiss whey' from milk.
2754. Thomas Russell Crampton, Adelphi—Improvement in furnaces, and in apparatus for supplying fuel thereto.
2756. Frederick Samson Thomas, and William Evans Tilley, 6, Kirby-street—Improvements in producing aluminium and its alloys, and in plating or coating metals with aluminium and alloys composed of aluminium and other metals.

Dated 7th December, 1855.

2758. Jean Joseph Emilien François Kuister, Lyons—Improvements in raw silk winding machinery.
2760. Henry Hart, 5, Waterloo-crescent, Dover—A ship leakage indicator. (A communication.)
2762. James Gardner, Plaistow, and Henry Gardner and John Carey Gardner, Leytonstone-road—Improvements in glasses as applied for the transmission of light.
2764. Charles Lenny, Croydon—Improvements in carriages.
2766. John Allin Williams, Baydon, Wilts—Improvements in machinery or apparatus for cultivating land.

Journal of the Society of Arts.

FRIDAY, JANUARY 4, 1856.

MEETING OF COUNCIL.

Wednesday, January 2, 1856.

The following Institution has been taken into Union since the last announcement:—

407. Caistor, Mechanics' Institute.

NOTICE TO INSTITUTIONS.

A meeting of representatives from Institutions in the neighbourhood, or within easy access of London, has been fixed to be held at the Society's House, John-street, Adelphi, on Friday, the 18th of January instant, at 6 p.m., to confer with the Council on the best means to be adopted for practically giving effect to the Society's scheme for the examination of members of classes, for the promoting of the formation of classes, and to discuss whether any and what steps are desirable to be taken in reference to lectures. In inviting to this meeting a section only of the Institutions, the Council has had in view simply their convenience, and with no desire to exclude any; on the contrary, the Council will be glad to have the attendance of representatives from any Institution in Union, whether near or distant.

The Institutions proposing to send representatives to this meeting, are requested to forward to the Secretary of the Society of Arts, a few days previous to the meeting, the names of those who will attend on their behalf. It is to be understood that this meeting is not to be considered as a formal conference, but simply in the light of a committee meeting.

ON THE METHODS NOW ADOPTED FOR PRESERVING MUSEUM SPECIMENS OF FISH.

The Jamaica Society of Arts having made inquiries as to the methods now adopted for preserving museum specimens of fish, and also the cost of the necessary vessels for that purpose, the information in the subjoined report has been obtained and sent out, and is now printed, as it may be of use to other Societies and individuals both at home and abroad.

REPORT.

Professor Owen, of the Royal College of Surgeons, gives the result of experiments made by him on the best medium for preserving fishes, and says, "The medium is glycerine, now to be had at a more reasonable rate than usual at Price's Patent Candle Manufactory, Belmont, Vauxhall. There needs no other trouble than to immerse the fish as soon as caught in a keg or wide-mouthed stoppered bottle of the glycerine. For colonial collections, a well-made keg would be the best; a *number* to be attached to each fish corresponding to a list, giving the locality, date of capture, and name of fish, if known."

Dr. Gray, of the British Museum, says, "for some purposes I prefer dry, and for others fish preserved in spirits. I therefore always pack a specimen of each kind each way. For general purposes the skin of one side of the fish and fins attached is sufficient. They are dried, nailed to a board, with sufficient quantity of tow or cotton beneath to give the proper convexity, and when dry, varnished. For wet preparations there is nothing like spirits. Rum and gin are good, as the sugar they contain assists the process. The fish should have one or more incisions made in one of its sides, to admit the spirit into the interior, to prevent the viscera from rotting. If they are to travel, each specimen should be wrapped round with tow or calico, or other wrapping, to prevent their rubbing against each other and thus spoil, and the vacant space in the vessel filled with cotton or some other light material. The best bottles for exhibition are the cylindrical jars, which I introduced here, without any contraction at the throat, as they require less spirits. Ours are made by Powell, of Whitefriars, who would supply particulars and prices."

Mr. G. F. Wilson, Managing Director of Price's Patent Candle Company, "expects that the best degree of concentration will prove to be one part glycerine and two parts water." He states that "perch and roach immersed in glycerine four months ago have now their colours unchanged."

Messrs. Powell and Sons, of Whitefriars, speaking of the bottles, say, "They are generally sold by weight, and we give the following prices for 'Tie-over Rounds on feet,' (the trade name for vessels of this kind, the mouths of which are to be closed with bladder or other material, instead of stoppers):—

Inches.		Inches.				lbs.	ozs.		
14	by	6½	Weighing about,		each	4	12	at 1s. 4d.	per lb.
15	by	5	,,	,,	each	3	0	at 1s. 2d.	,,
13	by	3	,,	,,	each	1	5	at 1s. 2d.	,,
8½	by	3¼	,,	,,	each	1	0	at 1s. 2d.	,,
14	by	5	,,	,,	each	3	4	at 1s. 2d.	,,

Cutting the bottoms adds 2d. a piece extra to the cost."

They say "we can make some larger, say from 12 to 30 inches high, *not* 36; these will be about from 6 to 10 inches diameter. We cannot make them larger in diameter, that height; we can make them 12 inches in diameter, but they will not be more than from 20 to 24 inches high; the prices of these large ones vary according to sizes and the quantity ordered, say from 1s. 6d. to 2s. per lb.

"We also supply for specimens stoppered rounds, of which the following are a few of the prices:—

In.		In.					In.		In.	
12	by	6,	no feet,	at 10s. 0d. each.		On feet,	9	by	4½,	at 5s. 0d. each.
16	by	4,	,,	at 4s. 3d. each.		,,	13	by	5½,	at 9s. 0d. each.
13	by	3½,	,,	at 5s. 0d. each.		,,	9	by	3½,	at 3s. 4d. each.
9	by	3,	,,	at 3s. 0d. each.		,,	6	by	2½,	at 2s. 0d. each.

"Messrs. Powell and Sons also supply oval jars, which for some specimens are more convenient than round; these vary in price from 1s. 8d. to 2s. per lb.

"The foregoing are the prices delivered on board ship, with a discount of 5 per cent. for cash."

P. Le Neve Foster, Secretary.

Dec. 31, 1855.

LIMITED LIABILITY.

The members of the Society have so long taken an interest in this important question, that it is thought desirable to call attention to the legislation which took place last session of Parliament in reference to it. The principle of partnerships with limited liability is admitted by the Act (18 and 19 Vict. c., 133) which has been passed, but the conditions under which Companies can take advantage of the new law, are such as to render it doubtful how far the principle has a fair chance of being tested. Every Company, formed or to be formed, with limited liability, must be formed under the 7 and 8 Vic. c., 100, commonly known as the Joint Stock Act, the provisions of which involve such a cumbrous machinery as entirely precludes any but large companies. The expenses both of formation and management under the latter Act, would be so burdensome on small capitals as practically to exclude all small companies. Whether this be an evil or not, may be a question, but, at all events, one of the reasons on which the limited liability principle has been advocated is prevented coming into operation. Mr. Wordsworth, in a note to this Act,* raises an important doubt, which, whether well founded or not, has already had, it is said, considerable influence in preventing the Act being so largely adopted as it otherwise would have been. The doubt arises from the wording of one of the clauses of the Act. Upon certain conditions being performed, the Registrar of Joint Stock Companies grants a certificate of complete registration with limited liability. Mr. Wordsworth says, "The mere granting of the certificate by the Registrar with the word 'limited' upon it, does not in itself confer limited liability. It only operates in furtherance of the previous requirements, when they shall have been *bona-fide* satisfied. It would seem, therefore, that in the circumstances refered to, the company would not be legally formed, and an innocent shareholder joining this concern some time after its formation, might find his liability would become *un*-limited instead of limited."

FLAX AND ITS PRODUCTS IN IRELAND.

Contributed by Wm. Charley, J.P., Seymour Hill, Belfast.

Letter XIII.

The next process we have to consider in regular rotation after grassing, is the separating of the fibre from the woody portion, or straw; this operation is technically called *scutching*.

When the Courtrai system is adopted as described in a previous paper (Letter XI.), the scutching, of course, cannot be performed till the retting and grassing are completed, probably, eight or ten months after the crop is harvested. If the agriculturist prefers to get rid of his flax at once, without the trouble of the various details which follow the pulling of the plant in the field, he will dispose of his crop in the green state to some of the owners or managers of the patent retteries of Shenck or Watt; but the ordinary, and after all not the worst system, both as to quality, produce, and profits, is to have the crop stacked for a few weeks after the grassing is completed, and during the winter months have it well scutched, tied up in bundles, and sent to market.

The scutching or cleaning of the flax was at one time effected entirely by *hand*-labour; even yet many of the small farmers employ their families, during the inclement months of the cold season, in scutching by hand in the house or barn. They value the labour, of course, very low, as the severity of the weather prevents the farm-work being prosecuted during a good many days every year, and if not employed thus, the younger branches of the family would most likely be sitting quite idle at the warm fire-side. Louis Crommelin describes his improved plan, A.D. 1705, to consist in putting the sheaf of flax on the barn-floor opening and spreading three-inches thick, taking care that the *roots* are all one way, then "clap your foot on the flax" and begin to thresh it with the mallet at the root-end first, keeping the foot always on the stems to make them steady under the blows; when the one side has undergone this operation, the bundle to be turned with the other side up, and threshed in like manner. The flax is then *broken*, and afterwards must be scutched. This is done by taking a wooden article, something like a broad knife, in the right hand, and in the left a bunch of flax; the fibre is hung through a nitch in an upright board, and is struck repeatedly with the scutching blade till the straw is driven off.

This was the treatment by hand in Louis Crommelin's day, and as there is scarcely any change in the style of manipulation, it may be taken as a fair exposition of this particular system.

The introduction of machinery driven by steam or water-power has, in a great measure, superseded the hand-labour. Mill-scutched flax brings a higher price in the market, and the operation by machinery facilitates the prompt preparation of the fibre from the unfinished to the saleable condition.

The first trial of machinery was the construction of an axis, with *horizontal* blades attached, which worked inside a circular box, with openings in the top, through which the flax was introduced and subjected to the striking action of the blades. This machine was found rather severe on the fibre, and a modification was invented which proved quite successful.

This plan exactly followed the position of the flax when being hand-scutched, using instead of the arm of the man, a horizontal shaft, with the wooden blades attached revolving and acting on the flax vertically.

This is the system of the present scutching-mills. The process of threshing by the mallet in the hand operation, is performed now in the mills by passing the flax between a set of rollers, which bruise it so completely as to render much more easy the after-separation of the straw.

The trustees of the linen manufacture, during their jurisdiction prior to A.D. 1828, directed great attention to improvements in the scutching process, and of late years her Majesty's government have shown a similar laudable anxiety to encourage the erection of superior mills.

In many parts of England and Ireland the want of flax-cleaning machinery convenient to the farmsteads is very much felt. The scutching is always rather an expensive operation, even in the north of Ireland, and in remote districts, where heavy carriage is required to a distant mill, the agriculturist is often much embarassed. All large proprietors, or, where there are not such, the local Farming Associations, ought certainly to see that every district capable of growing flax is provided with a good mill.

The Land Improvement Acts give power to the Commissioners of Public Works to lend money on favourable terms to needy proprietors for the erection of scutch mills in Ireland, so that our landlords have no excuse whatever for not providing their tenants with this important accommodation.

The estimated expense of the building, for containing about 12 stands for scutching, as sanctioned by the office of Public Works, under Act 15 and 16 Vic., cap. 34, is £88 18s. 0d., or in two stories, £95 6s. 0d. To this must be added the cost of the machinery, say a small water-wheel and gearing, with the shaft and blades attached, stocks and adjoining woodwork, and a set of rollers. The amount will vary very much, according to circumstances, and in proportion to the number of stands erected. A small mill with four stands would cost for this machinery about £60, while one with 12 stands would amount to £150. To these sums must be added the expense of the building, so that the relative costs would be approximately

Small mill, complete	£104
Large do. do.	238.

The size of a mill is, of course, or at least ought to be, regulated by the probable wants of the flax-growers in the immediate neighbourhood. The expensive carriage from distant farms is objectionable, and certainly unprofitable.

An improvement lately introduced, and found of much service, is the adoption of stocks so arranged as to *spring* in the operation of scutching, and thus prevent the flax from being injured by too severe action from the blades.

By these spring-stocks, combined with flat, projecting spring-rings, or wheels, in the shaft, the action on the flax can be so nicely adjusted, as to apply extra work to the fibre requiring such, and to save from useless waste any that is easily cleaned.

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* Limited Liability Act, with observations and notes by Charles Wordsworth. Esq., Barrister at Law, Counsel to and Associate of the Institution of Civil Engineers, London. W. G. Benning and Co., 43, Fleet-street, 1855.

The flax scutched in this manner will bring a higher price than that done in the ordinary way, as the fibre is left in a better and sounder state.

The adoption of steam power is not suitable for the ordinary scutch mill, for various reasons. The first outlay is too great, and the expense of working the engine too heavy. The machinery is required for only a portion of the 12 months, generally from August till February, and one-half of the year is thus comparatively lost, unless, indeed, some other kind of useful machinery is on the premises to be worked instead.

In retteries like Watt's, which carry on regular operations during the whole year, steam power is desirable and proper, but for ordinary country flax mills I cannot believe it to be remunerative, and strongly recommend the simple application of water power, which during the winter months can be procured in almost any district.

To economise cost of production is the great point in all manufactures, and as the expense of scutching comes very high in comparison with the relative value of the material produced, any plan that enhances this cost ought to be avoided. The scutching of the flax, including attendance of girls or boys, and carriage to and from the mill, costs about 1d. per lb.; now the fibre is afterwards often sold for 6d. per lb., so that the cleaning amounts to one-sixth, or 16⅔ per cent. of the marketable value! Of course some flax will sell at much higher rates than that I quote, but taking even the extra price of 8d. per lb., the cost of scutching will be 12½ per cent. This is, I think, more than the farmer can afford to pay, and it is to be hoped that ere long the charge will admit of reduction to ½d. per lb., or at most ¾d. So long as the scutchers expect to earn, during the six months they are employed, sufficient wages to keep them the whole year round, no reduction can be expected, but by judicious arrangement, and giving these people regular employment at some other useful and remunerative occupation during the spring and summer, the cost in wages might, I think, be reduced, and the millowner ought, from patriotic motives, to be satisfied with a very moderate profit for his machinery.

I do not wish to appear severe on the "scutching interest," but it is an undoubted fact, that the process is too expensive, especially for coarse flax, and that the sooner a reduction of cost can be effected, the better for the flax growing community and the public at large.

The total number of flax-scutching mills in Ireland in 1852, was 956, and of stocks* therein, 5,053. Of these, 926 mills and 4,722 stocks were in the province of Ulster, showing that this province still retains the lion's share of flax cultivation and manufacture.

The proportion of mills in all Ireland to the number of acres of flax grown, was, therefore, one mill to every 133 acres, while the proportion of stocks was one to every 272 acres.

The motive-power employed in the Irish scutch mills, in 1853, was—

Water only	865
Steam only	47
Water and steam	5
Horses	14
Wind	25
Total	956

The great objection to the ordinary mill is, I think, the expensive charges made for scutching, for with a little care in handling, the flax, if previously well watered and grassed, can easily be cleaned to the satisfaction of the most particular buyer. Some very ingenious inventions have however been patented to facilitate and improve the cleaning operation. Among them may be mentioned that of Robert Plummer, Esq., of Newcastle-on-Tyne, who thus describes his new rotary disc scutching mill:—

"The novelties in this machine are, the application of whalebone, wire, bristle, or other brushes, instead of the ordinary wood blades, and of discs instead of the radial arms, also an improved form and position of the scutching board. The superiority of execution lies in the fibre being much better and more quickly cleaned, and in its being made much finer (nearly heckled in fact), the tow or offal being also much cleaner, and of more value. Increased efficiency and economy are obtained by the disc enabling more brushes (or blades) to be put on the machine than can be put on the radial arms; by the discs being able to be set with brushes (or blades) on both sides, (so as to get both a right-hand and left-hand stand,) double work is done in small space and very nearly for the same power; by the discs keeping the fibre steadily on the scutching-board, and not lapping it round, and cutting and tearing it away at the ends as is done by the strong and rapid blows of the radial arms; by the superior manner in which the brush penetrates the straw, and splits and cleans the fibres from gum, as compared with blades, and by the form and position of the scutching board making the stroke fall on the fibre more perpendicularly, so as to produce a longer stroke. A machine of two discs will scutch *five hundred weight* of straw per day with *four* hands."

The rotary disc appears to be a good idea, and I hope it will have a fair and proper trial, and that the result may prove beneficial to the flax manufacture. I am not so sanguine about the system of brushes instead of blades, but it is an ingenious invention, worthy of being fully tested. The brushes would, I fear, soon wear out, and be a source of expense to have renewed; however, this defect may perhaps be remedied.

Mc Bride's patent machine is in high favour with some parties; it also shows considerable talent in the various details of construction. It is manufactured to order by the respectable firm of McAdam and Co., Soho Foundry, Belfast, and stated by them "to be perfectly self-acting, and to require no more attention after the flax is once put into the machine, no skilled workmen needed, and warranted to do a ton per day with the attendance of only four ordinary labourers or women. This machine, with the driving arrangements, costs £200, and requires four-horse power."

Wilson's machine is a medium between the hand-scutching and the ordinary flax mill; the price is about £20. C. Merten's patent (of Gheel, Belgium,) appears to resemble Mc Bride's in some respects, but "all clasps or holders for fastening the flax, or breaking machines, are dispensed with, so that the work is of the simplest possible kind, the attendants being all of the class of ordinary labourers, and the cost of scutching is thus largely diminished. The double machine will do, in the day of twelve hours, from 45 stone to 55 stone (of 16 lbs. each), according to the quality of the flax. The single machine does the half of that quantity. They are adapted for all kinds of straw flax, whether hard or soft, and can be altered in a moment to suit different qualities. The flax is scutched with perfect safety to the fibre, leaving the reed whole from end to end. It is evident that the yield of fibre from a given quantity of flax straw must be greater than in any of the ordinary modes of scutching. Hardly any tow, and no dust, is produced by the machine. The power required for driving the double machine is four-horse, and half the power for the single machine." One of these machines is at the Industrial Exhibition in Paris. If it performs all that the inventor proposes, this machine may also prove beneficial.

No doubt there may be many more new machines in existence than the few I have just named, but these are the best known and most spoken of. If any remarkable ones are omitted, I shall be very happy to receive a description of such from the inventor.

Well informed and practical men generally recommend the frequent use of a series of rollers, to bruise and break the woody part of the plant before submitting it to the action of the scutching-blades. The refuse taken off by these blades, technically known as "scutching tow," is of little value, and, consequently, the less time spent under this severe operation, the more likely is the result to be satisfactory. The flax is very little if at all injured by the pressure between the rollers; when this process is successfully applied much less scutching is required; thus, an important economy of waste matter is obtained, and at the same time the fibre is preserved in a more healthy and natural condition.

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* The stock is one scutching board, with its four or five blades round the shaft opposite.

The system of rollers in operation at Watt's patent rettery, near Lisburn, appears very perfect, and I am told the action on the flax is very satisfactory.

In erecting a new mill for cleaning flax, the owner should certainly avail himself of this information, and introduce the plan of rollers here recommended as a preparatory step to the other scutching process. I believe Watt's system of rollers is patented, but no doubt an arrangement could be made with him, or some other effective and useful plan adopted. I cannot conclude this letter better than by inserting in full the well-experienced views of a gentleman who has been good enough to give me the benefit of his experience, and who, from his intimate acquaintance with the scutching process, as well as all the other details of flax management, is enabled to give on these subjects as sound an opinion as any man in Ireland.

This paper was kindly written for me a few months ago, by Mr. John Macarten, of Waringstown, County Down, and will speak for itself, without doubt, better than any synopsis I could prepare:—

"I can add very little *new* to what is already known concerning the operation of scutching flax. One thing, however. I am convinced of, that the less scutching it undergoes the better. We all know that flax is the proper product of the plant, and that *tow* is produced by the injury the fibre receives in the process of separation from the woody matter of the stem.

"Having long thought that much improvement might be made in the preparation of the straw before scutching I last year (as land agent) got new rollers, of an improved construction. for Major Waring's flax mills, which have produced *more flax* than usual from the straw, with *less labour*. This effect is produced by the application of increased power to the rolling or breaking of the straw before scutching. which power is in part obtained by the peculiar construction of the rollers themselves; and the more completely the straw is broken without injuring the fibre, before being submitted to the operation of scutching, the yield is the greater, and of superior quality.

"Flax should not be scutched *immediately* after grassing, for the straw is 'husky' and *fresh;* and much of the fibre being carried away by the handles the yield is much deteriorated both in quantity and quality. By keeping the straw in stack at least a month before scutching, the fibre is much improved both in strength and silkiness, or as some term it, in "spinning quality." It is also improved by merely buffing it at the first operation, and holding it over 10 or 12 days before *finishing* it off.

"And now, permit me to add a word or two with reference to the growing and steeping of the plant.

"I have been in both France and Belgium, and paid great attention to the various preliminary operations as there conducted, and this is the result of my observations. They work the ground for flax as carefully as we prepare it here for onions, and use every means to have the soil as nearly as possible of uniform texture, both as to tilth and the chemical compounds of the land, using such manures as science points out to neutralise the excess of one ingredient and to supply the deficiency of another, so as to have all the soil of *equal quality*. Here, on the contrary, in some of our fields we find four or five *different kinds of soil*, and consequently four or five *different qualities of fibre* are produced from the same seed sown on even our best-cultivated farms. Unless we improve our land by a better and more scientific system of cultivation, we can never successfully compete with them in the production of FINE FIBRE for the cambric manufacture. Again, many farmers attempt to grow too much flax in one year, and are, therefore, obliged to sow too often in the *same ground*. As the result of my observations abroad, as well as of my own experience at home, I would say that flax should come in the course of a *long rotation*, and only be sown in the same field at an interval of *eight or nine years*. My own farm, indeed, from my previous ignorance of this most important point, is almost *sick* of producing it. In this respect I am of opinion that the exertions of the Royal Flax Improvement Society and the Chemico-Agricultural Society are calculated to be of immense service, by spreading among flax-growers a knowledge of the most improved systems of cultivation, as well as explaining the various organic matters which enter into the composition of the plant.

"The steeping is another operation the proper performance of which is of vital importance. Were I in the position of a landed proprietor, I would construct at my own expense a proper steeping tank or pool on each farm, *with a blue clay bottom* if possible, and provide for it a proper covering of stones, so that the farmer should have nothing to do but sow the flax. and would be sure, after a little experience, of having it properly watered. I have myself known flax to produce 5s. 6d. per stone *additional* from this operation having been carefully performed!

"In conclusion I would say, let due attention be paid to the proper growth and steeping of the flax, and then the farmer will have no cause to complain of the scutching, or to grumble at the price the produce of the crop will bring in the market. Science informs us that the object of steeping flax, is to dissolve the gummy or resinous matter which holds the woody part and the fibrous portion of the stem together, and as soon as that purpose is effected it should be immediately removed from the pond, for every hour after that, tends, in the continued process of fermentation, to weaken and rot the fibre, and in the process of time would render it utterly worthless. If, then, the steeping has been properly attended to, very little scutching will be required. I have often thought, indeed, that if any other means could be devised for the separation of the woody from the fibrous portion of the plant, we might dispense with the operation of scutching altogether."

APPENDIX TO LETTER X.

When writing last year (1854) on the subject of profits realised by the cultivation of flax, (see Letters IX. and X.,) I gave a statement of several crops grown by different individuals, who had kept regular accounts of the expenses incurred. I endeavoured to prove that an *ordinary* crop would leave a *fair* profit, whilst there was a probability of obtaining a *very high* remuneration from an *extra* crop.

Now, on examining the different statements I collected at that time, I was somewhat chagrined to find that my own profits appeared to be at rather a low average; however, as my farm books are kept more correctly than the majority of such accounts generally are, and as I knew the statements furnished by my land-steward contained "the truth, the whole truth, and nothing but the truth," I was impressed with the idea that some items might have been omitted by accident in the other calculations; but on looking over them carefully I could not detect any serious errors. My hightest rate of profit from 1844 to 1854, was £5 to £6 per statute acre, while, in several of those years, it ranged as low as £2 to £3. When I found that some other parties were surpassing me in the pecuniary results of the flax crop, I naturally became anxious to emulate so laudable an example. I stated in Letter X., that "I looked forward with hope to some favourable year to obtain an extraordinary crop;" so this season, acting on this resolve, I selected a nice well-drained field, that appeared exactly suitable for my purpose, both in soil and situation. An acre was measured off, but on re-measuring the ground after removal of the flax, it was discovered we had sown a little in excess, and had one acre and two perches. The seed was selected of choice quality, and every attention was given to the growing crop.

The fibre was carefully prepared for market, sold at a good price, and the result has proved so satisfactory that I am amply rewarded for my pains by the best crop of flax I have ever grown; and am not a little proud of having now reached almost the highest point of profit that I ventured to publish in my previous papers.

The following statement has been submitted to me by my land-steward, who kept an accurate account of the various items.

He states that the manual labour was rather higher this season than for some years past, owing to the great demand for labourers at harvest time; and that in ordinary years a saving might certainly be effected on this item of expenditure as now charged.

FLAX GROWN IN 1855, ON MR. CHARLEY'S FARM, 1A. 0R. 2P. STATUTE MEASURE.

EXPENSES.

	£	s.	d.
One ploughing, heavy furrow	£0	12	0
Seed, 2½ bushels	1	16	0
Harrowing, picking off stones, sowing seed, and rolling	0	10	0
Weeding	0	6	3
Cutting rushes, and making ropes of same	0	7	0
Pulling and binding	0	16	5
Carting to yard, and ripling under cover...	0	18	4
Carting to water, and fixing in same	0	7	6
Lifting out of water, and drawing to grass	0	5	6
Spreading on grass	0	11	8
Lifting off grass and stooking	0	5	10
Carting to stack-yard, stacking, and thatching	0	8	1
Loading and drawing to scutch mill	0	4	6
Carting from mill and marketing expenses	0	6	3
Drying flax bolls at corn mill	0	3	3
Cartage, &c., of bolls	0	3	8
Rent and taxes, 1a. 0r. 2p.	2	5	0
Scutching and stricking 53 stones flax, at 1s. 2d.	3	1	10
Total expenses	£13	9	1

RECEIPTS.

	£	s.	d.		£	s.	d.
For flax fibre, 4 stone, at 10s. 3d.	£2	1	0				
For ditto 49 ditto, at 10s...	24	10	0				
For scutching tow, 84lbs.	0	4	10				
For 60 bushels bolls for feeding, at 6d.	1	10	0	=	28	5	10
Profit					£14	16	9

Or £14 13s. 0d. per acre!

As the average produce in Ulster is 30 to 35 stones per acre, and the average profit £4 to £5, it will appear very evident that the result I now have the pleasure of reporting is an extraordinary success.

My land-steward says, that from the time of sowing the seed till the final sale of the fibre, every part of the management was fortunate and well-timed; even the weather, so fickle in our Irish climate, smiled on the arrangements, and graciously forbore to harass or retard the out-door manual operations.

For fear of any misapprehension, it may be well to explain why the sum of expenses on this acre, as now furnished, appears greater than the average cost of £9 to £10 previously quoted in Letter X.

The reader must bear in mind that this crop is fully *one-half greater* than the average, consequently, the cost of pulling, carting, scutching, &c., is increased in the same ratio of one-half, though rent and taxes, sowing and weeding, remain the same. This simple explanation will account for the apparent anomaly between the stated average cost of production and the present instance. It may also be interesting to state that the land was ploughed about the middle of November, out of *oat* stubble, the previous crop being turnips.

The field was thorough drained in the stubble after lea, in the very best style, and a portion of the success is no doubt to be attributed to this fact. The quality of the soil is a rich loam; the seed was sown on the 23rd of April, and the flax pulled in the last week of July.

It is rather curious that, being short of oats on my farm in 1854, that crop was substituted for wheat, and thus the flax followed an oat crop instead of wheat, as usual, for, I believe, the first time on my land.

One would very probably argue from this fact that the rotation I adopted this year is the most correct of all, and I should certainly be very unwilling, with a result so favourable before me, to question the propriety of such an argument; but it strikes me the *early ploughing* generally given to oat stubble, and often denied to that of wheat, is the true secret of the distinction. I should, therefore, strongly recommend, in addition to a good loamy soil and careful management of the crop, thorough drainage and early ploughing.

In conclusion, I wish particularly to impress on flax-growers the absolute necessity of becoming fully acquainted with the nature of the soil required for their purpose, and all the particulars of the most perfect management of the crop.

This will be best effected by reading, discussion, and practical experience. The last-named is by the vulgar very often but incorrectly placed first. This experience is frequently bought so dear, especially in agricultural matters, that impending ruin is often the result. Is it not plainly a wiser course to obtain a correct theory derived from the light of science and tested already by substantial practice?

Let this first be possessed, and when the head is clear and decided on the question, the skilful hands will labour with an increased and increasing reward.

BRITISH ASSOCIATION GLASGOW MEETING.

THE PATENT LAWS.

At the meeting of the British Association, held in Glasgow, the following proceedings relating to the Patent Laws, took place in Section G (Mechanical Science), on Friday, 16th September last.

The report of the Inventor's Fund and Patent Law Committee was read as follows:—

"At the meeting of the British Association in Liverpool (Sept. 1854), a committee, consisting of the Earl of Harrowby, the Dean of Ely, Colonel Sabine, Professor Graham, William Fairbairn, and Thomas Webster, was appointed, on the recommendation of the Mechanical Section (G), 'for the purpose of taking such steps as may be necessary to render the patent system of this country and the funds derived from inventors more efficient and available for the reward of meritorious inventors and the advancement of practical science.'

"The circumstances leading to the recommendation of the appointment of this committee were as follows:—

"Under the administration of the New Patent Law, which came into operation on the 1st of October, 1852, a fund amounting to more than £50,000 per annum is raised from the inventors of inventions for which letters patent may be applied for or granted.

"The raising of so large a sum of money, no less than its present appropriation, may be regarded as symptoms of disease in the patent system, and of defect in its administration.

"If the benefits conferred on the public by the well-directed labours of inventors are to be rewarded by recognising exclusive property in inventions for such a limited time as may be supposed to be sufficient for the perfecting the inventions in matters of detail, and ensuring their introduction into the arts and manufactures, and their adoption by the public, the funds levied on inventors in the first instance, and before any time shall have elapsed for obtaining any portion of such remuneration or reward, ought not to be applied to purposes foreign or even adverse to their interests,* and it would appear but reasonable that such funds, if levied, should, so far as possible, be made available for the encouragement of inventors and the advancement of practical science. Of such an appropriation, inventors, as a class, would have no reason to complain.

"It was under these circumstances, and with these objects, that the Inventor's Fund Committee was appointed.

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* An analysis of the appropriation of the funds raised from inventors, from October 1, 1852, to December 31, 1854, is appended at the end of this report.

"On considering the steps to be taken by the Committee for attaining the object of their appointment, the administration of the new patent system presented material obstacles to efficient progress.

"That system had been so arranged as to exclude the law officers of Scotland and Ireland from its administration, and to devolve the whole responsibility on the Lord Chancellor, the Master of the Rolls, the Attorney and Solicitor-General of England, whose other official duties are so numerous and engrossing as to prohibit their affording that attention to the development of a system confessedly so difficult as to be incapable of adequate administration without the co-operation of persons practically acquainted with the requirements of the system intended to be established, and for the establishment of which ample provisions and powers are contained in the Act.

"Under these circumstances, the Earl Granville and Lord Brougham, by whose exertions and watchful care, during the session of 1851 and 1852, the passage of the measure was secured, and others interested in the due administration of the New Patent Law, have already had the subject pressed on their attention, and there is reason to believe that the efforts of the British Association, if continued to be directed to this subject, will not be in vain."

ANALYSIS OF THE APPROPRIATION OF INVENTOR'S FUNDS LEVIED FROM 1ST OCTOBER 1852, TO 31ST DECEMBER 1854.

(Abstracted from the Reports of Commissioners of Patents.)

	1852—1853.			1854.		
	£	s.	d.	£	s.	d.
Fees to Law Officers of England, Scotland, and Ireland	21,716	1	0	8,649	6	0
Compensations	4.663	5	0	4,537	0	0
Salaries—Officers, Clerks	3,757	19	8	3,686	5	4
Commissioners' Office-expenses	3,987	4	4	3,432	15	11
Stationery	1,288	12	7	14,053	0	2
Rent of Offices	355	0	0	490	0	0
Printer and Lithographer	10,831	10	2	29,746	9	1
Purchase of Indices ...	1,000	0	9			
Surplus Income... ...	26,311	15	0	15,672	5	9
	£72,911	8	6	£53,030	4	2

Mr. W. J. M'QUORN RANKINE, read a paper on this subject, in which, while acknowledging the benefits derived from the amended patent law, he pointed out the following defects in its operations as subjects for discussion in the Section:—

1. The granting of patents for useless inventions.
2. The granting of more than one patent for the same invention during the currency of the provisional protection of the first.
3. The granting of patents for foreign inventions to persons other than the inventor or his assignee.

How far these evils were to be removed by improvements in the administration of the law, and how far, by improvements in the law itself, were subjects for further consideration.

Mr. FAIRBAIRN said, he had attended the meeting of British jurors at the Paris Exhibition on this subject, and after a long discussion they came to a unanimous decision that something should be done in order to give greater facilities for the encouragement of invention; and, also, that something should be done to reward the cultivators of science, who had spent their whole life in scientific pursuits. With respect to patents, he had the honour to preside as chairman at the meeting at Manchester, when the subject of the alteration of the patent laws was discussed. A great majority of that meeting were of opinion that there should be in patents, as in Manchester manufactures—free trade; and they were unanimously of opinion that £5 was quite a sufficient sum for a patent. Under the same circumstances, they thought, although a great number of useless patents might come forward, yet, after all, they would give encouragement to every description of inventions; for, although some might not be applicable to the purposes contemplated in those first views, yet they might suggest valuable ideas. And he thought the patent laws might be greatly improved were patents made still cheaper than they are. The price of £5 for the total expense of a patent was considered quite sufficient for office expenses, and the expense of the government officers, and the commission who might have the management of the patent system. And, provided that was done, they did not think it necessary to have any large fund at command for the law officers, or very high fees to carry out the principle.

Mr. WEBSTER apprehended there could be no doubt that the new patent law was a great instalment, but still it was not all that was wanted. The question on which the greatest conflict of opinion existed was, that of a uniform low fee for the granting of patents, without any check whatsoever. The objection to this was the inducement so offered to ignorant persons who would be decoyed on, by hopes of fortune, to make fruitless inventions, for which it would be a fraud to give them a patent. He was not aware of any single witness, of practical experience in these matters, examined before the committee in 1851—which was the most elaborate inquiry which had been made in any country, except the bulky reports by the American commissioners—who advocated free trade, that is, the unrestricted grant of letters patent without fees, and without some restriction and control. Invention consists generally in the application of known laws which persons of ordinary experience could pronounce to be possible or impossible, and it would not be expedient to afford, by the unrestricted grant of patents, that encouragement which the hopes of a fortune would hold out to speculative men: no country had done this. The object of such invention as could be the subject of patents had been accurately described by Mr. Rankine in his opening address to the Section, as the filling up the gap between theory and practice. Earl Granville, and some few other persons of eminence, had recently expressed an opinion that the whole patent laws were a delusion on the inventor, and the sooner they were swept away the better. He believed they were perfectly justified in such opinion, on the evidence afforded before the committee of the abuses of the old system. But with these exceptions, he was not aware of any persons who had studied the subject holding that opinion. He asked how they could draw a distinction between patent right and copyright? Both were the labour of mind; and the question was just one of brains against capital, which would go on as long as society existed. The greater portion of the objections pointed out by Mr. Rankine were provided for by the law, if fully carried out. They had all been stated and discussed before the committee of the House of Lords in 1851, and there was the power of dealing with every one of them. There was nothing so unreasonable, as at first sight might appear, in granting patents for foreign inventions—the success of inventions abroad was no guarantee for their immediate or even early introduction here. There was much to be said on this subject, as the history of such inventions would show. It was a notorious fact that the greatest inventions required a vast amount of perseverance and capital to force them before the public. It was not to be expected that a man whose old machinery would be rendered worthless by a new invention would encourage it, and masters were not always ready to encourage inventive talent in their workmen. It did not follow because an invention had secured a foreign reputation, that it would be immediately adopted in Britain, as was witnessed in the case of the galvanised iron, and many other inventions. As the bill originally stood it was compulsory, by the 8th clause, for the law officers to obtain the opinion of competent persons, but a committee of the House of Commons thought fit to make it optional. He believed the committee appointed last year had been instrumental in effecting important changes, and he thought the committee, recommended by the committee of the Section, with the assistance of the Duke of Argyll and Lord Harrowby, would secure many more.

Mr. ARCHIBALD SMITH was convinced that a majority of scientific men and the public were in favour of a repeal of the patent law, and he believed its days were numbered. He held it was the interest of the public, and not the patentees, that should be consulted in the matter. He formed this opinion on a comparison of the evidence given in 1828 and 1851; in the former committee no person was found to give evidence adverse to the policy of the patent law, while in the latter many were found to express such an opinion. This was a growing opinion amongst lawyers and young men of his acquaintance. He did not mean to argue the question on the present occasion, but merely to record his dissent and prophecy on the subject.

Sir DAVID BREWSTER was of opinion that patents should be given gratis—nay, that a bounty should be given be Government for every patent however frivolous. They wanted a great number of inventions; it was an advantage to the public as well as to the patentee. Patents should be absolutely protected, and he could not see the smallest evil that could arise from frivolous patents. No patent could be said to be strictly frivolous. The fact of a patent being taken out is the indication of a want in a particular direction—it was the result of a person seeing a want and trying to supply it. He might supply it in an imperfect way, but at last others would be attracted to the work, and this frivolous idea would eventually become the germ of some better idea in the future. It was in consequence of want of encouragement to improvements in implements of war that we have been so perplexed of late.

Mr. J. F. BATEMAN was opposed to the indiscriminate granting of patents, which inventors would find an excessive evil. He highly approved of Sir David Brewster's idea of bounties to inventors, but he feared the great multiplication of patents would compel persons who wished to construct a new machine to go round about the work, in order to avoid encroaching on old patents.

Dr. NORMANDY coincided in the views expressed by Sir David Brewster. The attempt to limit the number of patents presented great difficulties. Many inventions, thought to be useless when made, turned out to be extremely useful afterwards. Inventors deserved the protection of Government; many of them died in want, while the country was deriving great benefit from their inventions. He understood that the useless patent need not stand in the way of any inventor, for if useless it can be got rid of by *scire facias*. He approved of the system of annual payments, if any were to be exacted; but the present fees ought to be reduced. The old patent system was, happily, dead and buried, and need not now be adverted to.

Mr. WEBSTER, in reply to a question from Mr. J. Heywood, M.P., said, the practice of this country had been to remunerate the law officers for what they did by fees upon what they did not do; the fees paid by the Treasury for official business was not one-tenth of what would be paid by private individuals. The fees on patents might be regarded as an official salary; they received about £5000 under the old, and £9000 under the new system; but this was a fitting subject for administrative reform; the law officers should be paid liberally by a salary, instead of as at present.

Mr. NEIL ROBSON said, the cheapening of patents was much to be desired, and he hoped good would result from the labours of the Committee of the Association.

The Rev. T. R. ROBINSON, D.D., of Armagh, said he could not go the whole way with Sir D. Brewster. He did not think it necessary to stimulate inventors by a bounty, but he felt certain that it is unjust to make them pay for what ought to be theirs freely. No property can be held by so strong a right as that which man has to the offspring of his brain, the creation of his intellect; and any interference with it beyond what is absolutely necessary, is a gross injustice—an actual spoliation. Nor can it be justified on the plea of benefiting society at the expense of individuals; it is certain that, in the long-run, society cannot be benefitted by any thing opposed to the eternal and immutable principles of truth and justice,—and such is the levying from an inventor a single shilling that can be spared. The notion that by taxing him in this way you prevent useless inventions or absurd patents is fallacious. First—What are useless? Who, in this age of progress, shall decide on impossibility? Had George Stephenson sought, in 1805, a patent for a locomotive to travel fifty miles an hour, it would have been called absurd, and he insane. Then, as to preventing them by making them expensive, he could tell them this was impossible—he spoke from experience—he was often consulted about projects of perpetual motion, wonderful motors—such as a pendulum to go for ever, &c. In some rare instances, he had been able to show the projector his mistake, but in general he left him, resolved, *at any sacrifice*, to obtain the realisation of his vision. If his own pecuniary means were insufficient, his enthusiastic conviction deceives his friends, and they supply him to an extent far beyond any sum you can venture to levy. Even were it not so, what is this but penal legislation of the worst kind, penal on the exercise of intellect. If any such check be necessary, he could point out a far better mode of applying it; improve primary education, and give the mass of the people some knowledge of those elementary truths of mechanical and chemical science, the ignorance of which not only retards their industrial progress, but subjects them to the wild and ruinous delusions which we are considering. As to saying that the inventor must pay the officers who administer to him the justice which his nation is bound to give him—what can be more iniquitous! If there be any certainty at all in political science, this is amongst its axioms, that the State is bound to protect the life and property of all its members. Why then should this kind of property be dealt with differently from that in land or merchandise?—why should the judges who decide on it be differently circumstanced from those of the ordinary courts?—why should the system of paying them by fees, the worst that ever was devised, survive here, when the common sense of all is denouncing it everywhere else. It was said this mighty realm cannot afford the expense of half-a-dozen additional judges! The very interest of the money wasted since the beginning of the war, by neglect or ignorance, would far more than command a patent executive of the highest talent in the land, and secure it the independence which is essential to deal with the immense interests which are at stake. He (Dr. R.) dwelt on this, as he had observed it was the prominent grievance in the new law; it was real and definite, and if permitted to offer advice to the members of the section, he would counsel them to attack *it* exclusively at first, instead of weakening their chance by scattering their forces. If successful, there was little doubt that rapid progress would be made in removing all else that was really unjust to a class of men, who, though among the greatest benefactors of the world, were, as a body, the worst rewarded by it.

Mr. WEBSTER would refer to a few subjects which had been mentioned, and on which some misconception might exist. The principle upon which the new system was founded was of taking no more from inventors for new patents than the administration of the system might require; but it had been found necessary to provide a fund for compensation and for the law officers. Had more been attempted in 1851, the whole would have been lost. There were not less than fifty persons interested in the fees of the old system. The periodical payments had been adopted with the view of clearing away patents for inventions not in actual use, which, whatever might be thought, was a great practical impediment to the introduction of new inventions, inasmuch as it compelled the author of useful improvements to make arrangements with the owners of useless patents; the periodical payment was adopted with the full concurrence of the Manchester committee. The money check was not sufficient for checking patents for the delusions to which Dr. Robinson had referred, and it would be for the committee to consider what could be done. It was clearly unjustifiable to levy a higher tax than necessary on inventors in the first instance, but the periodical payments, as a tax on a remunerative monopoly, were not subject to the same objections. The application of these funds would be the subject of further consideration. Many of the observations that had been made had reference to technical matters, to which he would not refer, but he could not refrain from expressing his regret that a citizen of Glasgow, of such great eminence in mathematical and theoretical science as Mr. Archibald Smith, should have raised his voice against a system designed and calculated to encourage applications of science, from which such national advantages had resulted. The Earl Granville had pursued the true statesmanlike course of reforming a system, believed by the public generally to be beneficial and just.

The Earl of **Harrowby** expressed his gratification at the discussion on a subject of such importance. He thought Dr. Robinson had laid down the principles in a more extended form than could be maintained, as it would go to give property in an invention, during the life of the inventor, and even his representatives; in copyright it had been found proper and expedient to limit the term, and the same was politic in patent-right. He thought the inventor ought to be protected, and he could not agree with his noble colleague Earl Granville on this point, but the subject was one of some difficulty, and well deserving the attention of a committee of the British Association.

Subsequently the general meeting of the Association at Glasgow, previous to its separating, appointed the Duke of Argyll, the Earl of Harrowby, Sir David Brewster, Colonel Sabine, Professor Graham, Mr. William Fairbairn, and Mr. Thomas Webster, a Committee for the purpose of taking such steps as may be necessary to render the patent system of this country, and the funds derived from inventors more efficient and available for the reward of meritorious inventors and the advancement of practical science.

Colonial Correspondence.

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THE NATURAL RESOURCES OF BRITISH HONDURAS.

Belize, British Honduras, October 16th, 1855.

Sir,—I had the pleasure of forwarding to you a short time ago, a sample of fibre made from a species of the *Broumelia pita*. That was not, however, the real *broumelia pita*, or ixtle of Tehuantepec, but the *agave sisalana*, of Campeachy, called by the Indians *pita*. Of this *pita*, as I before stated, the inhabitants of Yucatan make ropes, hammocks, and a variety of other articles. I sent you by the last packet a hammock made of this fibre, and I now send you another hammock composed of the same material, which has just been brought to me from Campeachy.

Mr. Welsh, who has been for many years an extensive mahogany merchant in Belize, has recently established a manufactory of that wood, at Minatitlan, a small village, situated on the river Coatzacoalcos, in the isthmus of Tehuantepec. He has just returned from Minatitlan, and has brought with him several specimens of the vegetable productions of that portion of Mexico. Amongst these is a very fine sample of the fibre of the *broumelia pita*, or *ixtle*. It is upwards of six feet in length, very silky, and exceedingly strong. It appears to me to be far superior to the hemp and flax which are usually imported into England; and I think that a fabric much excelling the cloths which are made from those materials might be manufactured from it. The ixtle is by no means confined to the isthmus of Tehuantepec. It is very plentiful, both in the neighbouring state of Honduras and in the British settlement. The Creoles of this country call it the silk grass. I have sent you two specimens of the fibre from Minatitlan, one bleached, the other unbleached. I have also sent you some which I got from the river Ulad, the mouth of which is a little to the north of Omoa, in the state of Honduras. I have likewise sent you some of the fibre of the silk grass, or ixtle, of this country. I do not think that there is much difference in the quality of any of these fibres; that from Tehuantepec is certainly the most beautiful in appearance. But the Indians of that country having been long accustomed to the use of the ixtle, making of it every kind of fabric of which they stood in need, understand better how to select the plant, and how to prepare it. In the state of Honduras, and in this settlement, it has never been used for any other purpose but cattle whips and fishing lines. Mr. Welsh was kind enough also to bring me the plant itself, but as it appeared to be in a drooping state, I have put it in the ground, hoping that by that means it will revive. If it should recover, it is my intention to send it to Sir William Hooker, along with some of the same plants grown in the British settlement, to procure which I am about to despatch a person to the river Sibun, where they are to be found in great abundance. It is a species of aloe. The leaves are soft, dark green, from five to eight feet long, and an inch and a half or two inches broad. Along the edge of the leaf, at a distance of about six inches from each other, are short, sharp, strong, curved thorns; it is said that when cultivated these thorns gradually disappear. Any quality of the *pita* may be had. When young the fibre is shorter, but very white and soft, but when old the fibre is longer and much coarser. The manner in which the Indians of the isthmus manufacture the fibre is primitive enough. They place a small board upon the ground, and standing on it with one foot at each end they draw up the leaf which is placed underneath it. This is to make it flat and smooth. They next place the leaf upon an inclined plane, and with a rude instrument, made of bone or wood, having a piece of iron inserted at one end, they scrape off the outer green covering, and the fibre is then developed without further trouble. It is afterwards bleached and dried. I have sent you two of the instruments which have been used by the Indians for this simple mode of manufacture. One is made of bone, of what animal I am unable to say; but I strongly suspect it was not a quadruped, (human life is cheap in this part of the world), and the other of mahogany and iron.

There is a tree in this country and in Mexico, called the Mammee; it is a tall, straight tree, spreading at the top, and having long dark green leaves, with down on the outer side. It bears a fruit about the size of a cocoa nut when denuded of the husk. The rind of this fruit is rough, and of a pale brick colour, or perhaps it comes nearer to burnt sienna. The inside is soapy, of a yellowish pink colour, and has somewhat the flavour of molasses, with the addition of a little lime juice and a touch of the tar-brush. You might imagine that it is no delicacy; the natives, however, eat and relish it. But what will they *not* eat, "bless their stars, and call it luxury?" It contains a large oval seed, of a blackish brown colour, and highly polished, the kernel of which has a strong taste of prussic acid. The Indians cut the kernel in small pieces, roast them and mix them with their chocolate; some take them alone. It is said to be agreeable, nutritious, and sedative. An infusion of the dried leaves is a powerful narcotic. The infusion of the bark is a narcotic and a tonic. The Indians of Tehuantepec extract an oil from the kernel of this nut, which they apply to their hair, and to which they ascribe certain medicinal properties, but what they are I have not heard. I have sent you a small quantity of this oil, which was brought from

Tehuantepec. If some analytical chemist connected with the Society would undertake to analyse it, perhaps it might be found to possess several valuable qualities. It could be made here, as well as procured from Minatitlan, in large quantities. The seed itself could also be sent to England. I have sent you the rinds and seeds of two of the fruits. I have been favoured with the following description of the mammee tree by Dr. Young, a long resident in this country:—

"Mammee apple, or *Mammee Americana*, belongs to the natural family of Guttiferæ, and forms a fine spreading tree. The fruit is large, with a double rind, the inner one very bitter. The pulp contained within these has an agreeable taste and slightly aromatic smell, and is much esteemed. Each apple contains a single seed, as large as a hen's egg. The flowers are used in flavouring a liqueur made in some parts of the West Indies, called *eau* or *creme des creoles*. There is no doubt of a fine oil being contained in the seed. I am disposed to think the mammee tree indigenous, as it is to be found in retired parts of the forests, and the fruit from its stone is not likely to have been carried there by birds."

I sent you by the last packet some of the bark of the Honduras *cinchona*. I now send some grown in Tehuantepec. The sea air, to which it has been exposed, I am afraid has injured it, and considerably diminished its bitter quality. When in good order, it is as bitter as the *quinquina* of Peru. The Mexicans consider it equal, in intermittent fevers, to quinine.

An inspissated juice is procured from the tree in Tehuantepec, which the natives call amber gum. That is all I know about it, but I send you some in a small calabash, in order that it may be examined. I think it might be used as a varnish. I have got a considerable quantity of it, but it is in a vessel which is much too large to send by the packet. I will, however, forward it to you when a cheaper mode of transit presents itself.

Mannatees, or sea calves, are found in certain parts of British Honduras in great numbers. They are frequently caught and brought to the market in Belize, where they are snapped up with the greatest avidity. The flesh is very white and delicate, something between pork and veal. The tail, which is very fat, is most esteemed. This caudal luxury is generally soused, or pickled. I do not myself fancy the flesh of this brute, for it is so inhumanly human—it reminds one so much of a mermaid, or of one of the fifty daughters of Nereus—that to eat it seems to me to be an approximation to cannibalism. It appears horrible to chew and swallow the flesh of an animal which holds its young (it has never more than one at a litter) to its breast—which is formed exactly like that of a woman—with paws resembling human hands. But these notions would be considered highly fantastic by those who masticate a monkey with the greatest relish—partake with *gusto* of rattlesnake soup—and voraciously devour an alligator stew. The mannatee is commonly found in shallow water, at the mouths of rivers, where it feeds upon the marine herbage which there grows in great luxuriance. It has no teeth, but two thick, smooth, hard, unserrated bones run from one side of the mouth to the other. I am inclined to think that these bones might be used as a substitute for ivory. I shall endeavour to send you some. I shall likewise send you some alligator's teeth. These are very hard, white, and polished. They might be used for a variety of purposes. In this country they are used by smokers to extinguish the fuse with which they ignite their cigars. The tooth is hollowed, bound and tipped with silver, and fixed to one end of a chain, at the other end of which a steel is attached, for the purpose of striking a light. The fuse consists of the bark of a tree enclosed in a piece of dry cotton.

It is well known that the alligator emits or throws off an odour resembling that of musk; the proximity of the animal is always denoted by that scent. In proceeding along the various rivers of this country, it has often been to me very perceptible. The odoriferous substance is supposed to reside under the fore fins. It is worth while ascertaining the exact affinity which the substance bears to real musk. I have made arrangements for the capture of an alligator, from which (when caught) I shall extract this substance. Perhaps if I were to bottle up some of his tears, they might be useful to a few modern professors of philanthropy, or sympathisers with poor, distressed, ill-treated Russia. Alligators are much more plentiful than musk deer, and if the odorous material which those amphibious monsters possess could be used as a substitute for the expensive secretion of the deer of Thibet or Siberia, an alligator fishery would be productive of good in more ways than one.

I have the honour to be, sir,
Your very obedient servant,
R. TEMPLE.

Home Correspondence.

CORT'S INVENTIONS.

SIR,—It was to be foreseen, as the inevitable consequence of agitating in your columns the painful question of the treatment of Mr. Henry Cort, that our national honour would suffer throughout the world, wherever your valuable pages circulate. But true honour can never be attained by cloaking a dishonour, which, so far as the public at large is concerned, has been incurred much more by ignorance than intention. The extraordinary patience of Mr. Cort's children under cruel neglect, devoted to an independent life of honest industry, has suffered to rest in silence a matter a thousand-fold more important than a thousand subjects which have in the interval been loudly sounded, and obtained pensions and testimonials. The injuries and misrepresentations inflicted by a few designing men have remained as it were concealed from the public knowledge, and we can hardly blame a nation for being ungrateful when not informed of the debt of gratitude it owes. I have been led to write these remarks by perusing a severe article in the *Scientific American*, of the 15th December, headed "Gratitude to Improvers of the Iron Manufacture." The article commences:—"Republics have been accused of pre-eminence in ingratitude, but are monarchical governments stainless in this respect? Let us take a case, and try it." The writer then proceeds with a summary of Cort's inventions, as detailed in your pages, "now used in the manufacture of bar-iron in every civilised country under the sun. All nations are his debtors; the benefits conferred upon them by his inventions are beyond calculation, and have raised Great Britain from being an importer of iron from Russia, America, and other countries, to be the greatest iron manufacturer and exporter in the world." He then narrates how the inventor was ruined "by a deputy of the Navy, who saw at once the value of the improvements, and privily supplied capital from the funds entrusted to his care," and after recounting the subsequent flagitious events, and the amount in dollars of the "boundless generosity of the British Government," concludes thus:—"Oh! what ingratitede! Can any republic be more ungrateful—has any republic ever exhibited so much ingratitude? We think not. Do not let the British public throw the blame of such ingratitude upon their government; they hold the purse-strings, and the blame must rest on them. One of Henry Cort's sons and three daughters, each over 70 years of age, are now living in indigent circumstances in England, while the nation has grown rich on their father's discoveries. If the monarchy desires to show its gratitude, here are worthy objects for its display. May such charges never have to be made against our own country."

Truly, no step should be omitted that may tend to exonerate us from charges such as these. The Society of Arts has commenced the reparation of these great wrongs by instructing the people on their existence. A most important paper is now in progress at your meetings, displaying the results of these great inventions in foreign nations as well as in our own. Can the Society of Arts have a nobler opportunity of doing further justice in the cause they have espoused? May I hope that it will be compatible and consistent with your forms and with your objects, as a means of disclaiming the imputation which has reverberated across the Atlantic, that when the Chairman moves, on the 9th of January, the vote of thanks which Mr. J. K. Blackwell will have so well deserved, there may be coupled with it a vote "of thanks and sympathy to the memory and the merits of Henry Cort, whose inventions, by furnishing the existing means of manufacture, have supplied the materials of this elaborate paper, and afforded the Society the gratification and instruction of listening to its perusal." I cannot doubt that a vote to this effect would be carried by acclamation.

I am, Sir, your obedient servant,

DAVID MUSHET.

December 31st, 1855.

A PLAN TO RENDER POPULAR INSTITUTIONS MORE EFFICIENT.

Sir,—I desire to submit to the Council, and, through the *Journal*, to the Associated Institutions, a plan for supplying a felt and confessed want. This is done with a conviction that definite, systematic, and useful teaching, is the only thing which can raise these Institutions to their true position.

It would be easy to dwell upon the pecuniary, social, and moral advantages certain to accrue to the members of popular Institutions from their advancement in useful knowledge, and from the intellectual culture by which it is always accompanied; to show how improvements in arts and manufactures may result from the better training of those engaged in them, and how the practical and the scientific would thus be more closely associated, to the great advantage of the State. This is unnecessary, save with persons who doubt the usefulness of popular education, whereas the present suggestions are addressed exclusively to those who are convinced of its utility and engaged in its advancement.

The true function of Mechanics' and similar Institutions is, to take up the bulk of the population where the schoolmaster leaves it, and to carry forward its education as far as the daily duties of life will allow. Amusements form a legitimate addition to the severer part of their duties, but unless a considerable educational advance is made by their means, much well-meant zeal and labour are ill bestowed.

The most intelligent managers of these Institutions feel strongly the necessity for some more educative proceedings than they have adopted hitherto, but are at a loss how best to attain this end.

Believing that one course only can raise these Institutions to the highly useful position they are destined to occupy, and that no existing body can do so much to forward this advance as the Society of Arts, I venture to hope that the present, or some similar plan, will meet with the approval of the Council, and will be reduced to practice.

Certain common-sense maxims have been so frequently forgotten in the practical conduct of popular Institutions, that they need to be stated at the outset.

No more should be attempted than can be done well.

Quality and not quantity must be aimed at.

Mental discipline is the true object of education.

I shall assume at once that amateur-teaching is useless for the purpose of real education, and that competent paid teachers must be provided in every case, or the work be left undone.

The few remarks I propose to offer in this preliminary memorandum may be arranged under the heads of

I.—What is to be done.
II.—Means for its accomplishment.
III.—Whence can the funds be derived.

I.—The true work of popular Institutions is the carrying forward education begun at school. They forsake their province when they assume the place of the elementary schoolmaster; and aim at the unattainable when they strive after the grasp of University Professors. They fulfil their mission when they labour to perfect the work begun in the elementary and commercial schools, and stand to the pupils of these in the same relation as Universities stand to those who have passed through our great public schools. Both should give to their members intellectual culture, which may be applied to any technical necessity of their walk in life, but neither can attempt the technical without vacating a higher vocation.

I apprehend the instruction should be divided into two courses, and, if possible, every student should pass through the first before attending the second. Where this cannot be, he should be required to pass an examination in the subjects of Course I., or to have attained such an age (21?) as to leave the responsibility of failure entirely upon himself, if he resolve at once to attend the higher instruction.

The first course would include the *principles* of knowledge, and would rather aim at making the student truly master of the stores he appears to possess than attempt to add much to them; whereas the second course need have no limit but the capacities and opportunities of the teacher and the taught.

Probably the most successful plan of instruction would be found that wherein the pupil procures and endeavours to master an approved text-book, and the instructor vitalises the book, and in a conversational lecture adds such supplemental or illustrative matter as he thinks adapted. No other system seems so likely to secure on the pupil's part that mental effort which is necessary to culture, or on the instructor's that due amount of help which makes effective the labour of the instructed.

The things to be taught form two divisions, each of which would require its proper teacher.

Division I.

Elementary mathematics, including arithmetic, algebra, geometry, mensuration.

English language, from spelling up to the most refined criticism.

History—(query, English only?)—from the usual dry facts taught under this name, to Hallam.

Geography, from maps and names to *Cosmos*.

Division II.

Chemistry, as the basis of common knowledge, and not as a technical science.

Science of common things.

General physics.

It is difficult to convey an accurate idea of what is intended in the scientific portion of the instruction without enlarging to an extent beyond the scope of this paper. The best illustration which occurs to me at the moment is that they shall do for their members (*mutatis mutandis*) what the Royal Institution does for its subscribers. They are not to make analysts or electricians, but to teach as much of science as will improve practice. The scientific teaching would vary with the character of the locality in which it was given; and in the adaptation of it to existing wants would consist a great portion of the teacher's skill.

Towns, with their surrounding districts, are divisible into agricultural, manufacturing, mining, commercial, seaport, and mixed; and it is obvious that what would be invaluable at Lincoln or Exeter might be comparatively worthless at Liverpool; while what Manchester prized would meet with deserved neglect at Portsmouth. The *local* character of much of this teaching is an indispensable requisite of success.

An interesting and instructive feature of this department would be occasional visits of the teacher and his class to neighbouring manufactories, &c., to which the managers of the Institution would procure them access. A few preliminary lectures on the principles and details of the processes carried on would excite a laudable curiosity, and add zest to the visit, while a review in some subsequent lectures of what had been seen would fix the whole in the minds of the visitors, and make them appreciate an educational system thus carried out.

From this outline of what is to be done we turn to the means for its accomplishment. These are, a teacher for each division of the instruction, maps and diagrams for Division I., a laboratory and its concomitants for Division II., and a museum, which may be used by both teachers as well as by occasional lecturers who might visit the Institution.

The subjects of Division I. are quite within the grasp of a person of fair education, and may serve to fill up all his time. If he deliver two lectures a week in each subject, and each subject be divided into two courses, his instruction will occupy 16 hours per week.

If the same rule be applied to the scientific division the lectures will amount to 12 per week, and if, to this be added the charge and arrangement of the museum and laboratory, it appears fully as much as most men could do efficiently. Before a person can be fit to discharge the duty of an instructor such as I am supposing, he must combine the possession of knowledge with an aptitude for communicating it, things which do not by any means always accompany each other, but which are indispensable to the avoidance of certain failure. Since it is altogether improbable that the managers of the Institutions themselves would be able to ascertain the qualifications of candidates for teacherships, it is proposed that all agree to appoint no one who has not a certificate of competency under the seal of the Society of Arts, and that the Society charge itself with the examination of any person desirous of the office.

The local managers would, of course, have the entire power in the appointment and removal of the teachers, and they must, therefore, assume the responsibility of inquiries into their moral qualifications, holding the Society of Arts responsible for nothing but what was contained in its certificate.

There is little room for doubt, that demand would soon create supply in this matter, and that a certificate fairly won in an examination beyond suspicion, would be an object of ambition to many persons highly qualified whose merit must now be doubtful owing to the common system of giving testimonials.

It would be essential to success that the Society should annually depute some one to visit the Institutions, examine the pupils, and report generally to the Council; a copy of such report being *at the time* sent to the local managers.

At these examinations, class lists in the order of merit, would be suspended in the rooms of the Institute, and an award made of any prizes for which funds existed.

The expenditure necessary to carry out this plan would be that of the Society of Arts, on account of the examinations and (at first) organisation.

That of the Institutions for salaries and wear and tear, and (at first) the fitting up of suitable lecture rooms, laboratory, and museum.

The Society of Arts would, I think, have no difficulty in raising a special fund for this purpose. Many wealthy and benevolent persons desire the spread of *bona fide* education among the classes for whom these Institutions are designed, and stand aloof because they doubt or deny the educational character of what is done at present. If they were once assured that a reality was to be attempted in an earnest spirit, they would readily assist in its furtherance. But could funds be obtained to meet the local expenditure? I think they could. Donations and subscriptions would certainly be obtained at the outset, and would, probably, last long enough to give the scheme a fair trial. Should it succeed they would not be likely to fall off, and if it did not there is no reason why they should be continued.

In this, however, as in all other things which are to last, self-reliance is the true ground of trust, and they who are benefited must be prepared to pay for the advantages they receive. The following considerations will show they are able to do this, if, like their incomes, the payments be required weekly.

An Institution in a town of 20,000 inhabitants would, probably, have the following attendance at the rates of payment stated:—

Fee for Course I., 3d. per week.
Fee for Course II., 6d. per week.
Text-books to be found by pupils.

Division I.—Course I.

	Pupils		Fees.		d.		s.	
Mathematics	40	×	3d.	=	120	=	10	per week.
English Language	40	×	3d.	=	120	=	10	,,
Geography	20	×	3d.	=	60	=	5	,,
History	20	×	3d.	=	60	=	5	,,
							30	

Course II.—Half the pupils at double fee = 30s. per week.

Total fees, Division I., £3 per week.

Vacation, 10 weeks in summer.
2 weeks at Christmas.

Total 12

Fees, 40 weeks × £3 = £120 per year.

Lectures on each subject per week ...	2
No. of subjects	4
	8
No. of courses..............................	2
Weekly total	16 lectures.

Division II.—Course I.

	Pupils.		Fees.		d.		s.	
Chemistry	40	×	3d.	=	120	=	10	per week.
Science of Common Things............	60	×	3d.	=	180	=	15	,,
Physics	60	×	3d.	=	180	=	15	,,
							40s.	

I do not apprehend any falling off of numbers in the higher course of this division, and, therefore, the fees would be

40s. × 2 = 80s. = £4 per week.

Total fees, Division II.—40s. + 80s. = 120s. = £6 per week.

Fees, 40 weeks × £6 = £240 per annum.

Lectures on each subject per week	2
No. of subjects	3
	6
No. of courses	2
Weekly total..........................	12 lectures.

I believe these sums would secure the services of competent instructors; and though it would be desirable to augment them ultimately, yet they would suffice to test the plan long enough to remove it from the region of speculation to that of knowledge.

Local subscriptions and donations would assuredly suffice to meet the wear and tear, and the only subject of difficulty would be the fitting up an adequate laboratory and museum.

If my notion of the latter be a correct one, its cost would be small.

Each museum ought to differ from every other, and to bear written upon it "LOCAL," in unmistakable characters.

The industry, geology, mineralogy, &c., of the immediate locality should be so represented that members could study them fully and accurately, and no attempt should be made to collect specimens with any other view. All things foreign to the locality should be strictly illustrative of local ones, and if not, should be excluded by the rules. This would give a maximum of utility with a minimum of cost, as nearly the whole of the objects would be presented by friends, or obtained by a little labour of members of the Institute.

It is obvious to remark that Mr. Twining's museums would find congenial homes and furnish topics for valuable lectures under the second head of Division II.

The laboratory (including maps and diagrams) would be the most costly thing, and, in the majority of cases, some extraneous help towards the expense of this would be indispensable. Should the Society's special fund be adequate, it might render assistance to the extent of say a third of the cost. It might also reduce the expenditure nearly another third by suggesting instruments less costly than, but equally efficient with, those in the catalogues of philosophical instrument makers. Institutions of this practical character should pay nothing for appearance but all for use. The Society would also obtain a trade reduction on this portion of the Institutions' purchases as it does on books. With such an amount of help, I believe, the obtaining of what is required would be generally practicable.

I am, Sir, your faithful servant,
W. R. BOWDITCH.

St. Andrew's, Wakefield,
December 1st, 1855.

[⁂ The Council call attention to the foregoing letter, and invite discussion on its contents, and at the same time would refer members and Institutions to the correspondence received by the Industrial Instruction Committee of this Society, and printed as an Appendix to the Report of that Committee.[*]]

DECIMAL COINAGE.

SIR,—I have read with much interest the letter of Mr. Franklin, in your *Journal* of the 21st December; an interest increased by a rumour that has for some time prevailed, that several of the more active leaders of the "Decimal Association" have been using their influence to obtain that gentleman's appointment as Secretary to the Coinage Commission. This circumstance would afford a sufficient explanation, why, "since the appointment of the Royal Commission, he has abstained from public controversy," on the important question to be determined, he having been previously, in common with the rest of his party, very far indeed from "content that the whole inquiry should be re-opened." The Commission, however, owe it to their own character for impartiality to appoint as secretary one whose mind is capable of an unprejudiced examination of the evidence, for with two out of three members subscribing approvers of the pound-and-mil plan of the association, they would render all their proceedings justly suspected in the eyes of the world, where they to appoint as secretary one who is an out-and-out supporter of that delusive scheme.

I cannot allow some passages of Mr. Franklin's letter to pass without remark. He appears to think that the commission "will virtually have little to do beyond making a selection between the penny and the pound as the *norm* of decimalised reckoning." But surely, (to say nothing of several other decimal systems proposed, all having certain advantages and disadvantages of their own), by far the most important business of the Commission will be to determine whether the theoretical benefits to be derived from any change will counter-balance the practical advantages of the existing system to such an extent as greatly to outweigh the certain mischief resulting from the change itself. This branch of the subject, which ought to have been the preliminary inquiry, was strangely ignored by the one-sided Committee of the House of Commons, and has still to be entered upon in serious earnest if any practical result is to be obtained. The first question for the Commission will undoubtedly be whether this country, which has long possessed the most complete and satisfactory currency of European states,—a coinage of world-wide fame,—is to sacrifice the great advantages which it possesses, and undergo all the disturbances inherent in a social change of such a magnitude as that proposed, in order that accounts may hereafter be kept on an entirely new system, which everyone who chooses is even now at perfect liberty to adopt, but which it is sought by means of compulsory legislation to enforce upon all.

My chief object, however, in addressing you is to point out some errors in Mr. Franklin's letter, which materially diminish the weight of his argument.

1. I should much like to know when it was that France adopted a "double standard." I have seen letters from the chief of the Bank of France, written within the last few weeks, affirming most decidedly that silver is the *only legal* standard in France. The *circulation* of gold has, undoubtedly, greatly increased in France and America, and also (but in a much smaller degree) in Germany, and it is possible that at some future period France may adopt a double standard as a measure of transition to a gold standard, but at the present time no such double standard exists, and, consequently, it can have no influence on the fluctuations in the price of silver. I may add, that the probability of the future adoption of gold, as either a partial or the sole standard of value in those countries in which a *low unit* of accounts is prevalent, is in itself a sufficient refutation of the charge advanced by Mr. Franklin, and others of his party, against the advocates of a low unit here, that they have a "covert design" thereby to alter the present English standard of value.

2. I suppose it is an inherent defect in the minds of some advocates,—but it certainly is a great misfortune,—that they can never state the case of their opponents or even their own fairly, and without perversion of the facts; at all events, the mode in which Mr. Franklin states the controversy between the advocates of the pound and mil, and of the penny system, proves clearly enough how ill-adapted he would have been for the office which his friends are stated to have been so anxiously seeking in his behalf. He calls it "the penny *versus* the pound and shilling;" further, that the advocates of the latter say, "Proclaim that the twentieth of the £1, or shilling, shall, after a certain date, be equivalent to 12½ pence, instead of 12," while those of the former "plead for the building up of a new decimal coinage upon the basis of the intact penny, discarding both pound and shilling in the process;" a greater inaccuracy in representing the real facts of the case it is scarcely possible to conceive. It is, as Mr. Franklin very well knows, the great merit of the penny system, that instead of "building up a new decimal coinage," and "discarding both pound and shilling in the process," it *preserves every existing coin unchanged, either in name or value*, while the pound-and mil plan "*discards*" *a large proportion of the existing silver coinage, gives to all the rest, except the new hybrid and un-English florin, and including the "shilling," new denominations, and alters the entire copper currency both in value and in name.* Both systems, and both equally, relinquish the shilling as a term of account. What, too, does Mr. Franklin mean, except to mystify the subject, by stating it as *the* distinguishing feature of the pound-and-mil system, the one thing which its advocates "proclaim, that the twentieth part of £1, or shilling, shall, after a certain date, be equivalent to 12½ pence instead of 12?" In what part of that system does the word penny occur? and where could *such* a penny be found in

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[*] Report of the Committee appointed by the Council of the Society of Arts to inquire into the subject of Industrial Instruction, with the Evidence on which that Report is founded. Longman and Co. 1853.

it, except by the depreciation of the existing coin, or the substitution of some other in its place? But the advocates of the system have over and over again proclaimed that it cannot be carried out, except by the abolition of the penny both in value and in name, and the great question among them has recently been, whether this could most effectually be done by coining two-mil pieces alone, or five-mil pieces in addition to the two.

3. It is hardly necessary to notice that part of Mr. Franklin's letter which relates to the future coinage of Germany. We have quite enough to do with our own affairs, without *dictating* to other nations; I only refer to it for the sake of noticing that after a tissue of the most curious assumptions, such as that Germany will adopt the very singular standard of 93 $\frac{14}{15}$ per cent. fine gold, on the strength of his recommendation, of that peculiar per centage, and that the ratio of the value of gold to silver hereafter to be fixed at 15 $\frac{8}{24}$, he arrives at the conclusion that 200 thalers = 300 florins (English, I presume) = £30 sterling, to which, let me add = 720 tenpennies = 7,200 pence, showing that all these assumptions, absurd and improbable as they are, gives him no advantage in the present controversy. But, in truth, it requires very little knowledge of commercial affairs to be aware that if this or any other ratio between the coins of two countries were to be established to-morrow, the difference in the rate of exchange would very speedily render all such pre-determined relation useless and of no effect. They are, therefore, nothing better than idle speculations.

I am, Sir, yours, &c.,

J. E. GRAY.

December 29th, 1855.

DRAINAGE OF LAND.

Sir,—During the discussion on this subject on the evening of the 21st, allusion was made to a very important matter, namely, the means by which the outfalls should be enabled to empty themselves at a proper level. The question of drainage itself is exhausted, and requires no comment. In order to obtain the richest crops, drain as deep as you can get the water to run off, and irrigate where necessary and possible.

The main impediment to an effectual and permanent system of drainage being fully carried out, is the fact that every river and stream in this country is obstructed throughout its whole length from the source to the mouth, wherever a foot or two of fall for water-power can be gained. Were this impediment removed, as it must be before anything like a general system can be shaped out, drainage would become a very simple operation, requiring no very great engineering abilities to carry out. Every hedger and ditcher knows how to cut off the springs from higher grounds, and is also well aware that the best drainage is that which has the lowest outfall.

Rivers and streams form the arterial drainage of a country, and when they are obstructed by dams and weirs, nature is outraged, and vast injury must necessarily ensue. These obstructions, which have existed, for some purposes from time immemorial, but for mill-power only since the time of the Crusades, were but of little consequence with a scanty, ignorant population, who scarcely cared whether they trod in knee-deep mire or not. Now, every inch of land is required to produce its utmost, and the time is fast approaching when these obstructions will be swept from the face of the earth by their substitute, steam-power, or the inevitable result will be, that we shall be compelled to make use of that same power in order to pump out our waste-water and drainage into the ocean.

The improved productiveness of well-drained land will ultimately be able to buy up and destroy every water-privilege in the kingdom,—in addition to which there is this consideration, that the enormous loss of property and even life from periodical inundations, is mainly caused by weirs and dams placed across the rivers, as well as by their general mismanagement in this and every other country.

All obstructions have the virtual effect of greatly diminishing the total fall to the level of the sea, and prevent the freshes from scouring out the bed. A river allowed to meander in a variety of eccentric curves and windings over an almost level plain, increases its actual length, say, five or six times what it would be if it pursued a tolerably direct course, and therefore diminishes its total fall to the sea to the same proportional extent. The same effect also most surely follows when a river in flood is allowed to overflow and devastate hundreds of square miles of territory, more or less, when that same flood, confined within its banks, would be a most effective and economical agent for scouring out and deepening the bed of the river. Where water may be required for irrigation, or for the uses of man, pump it out of the river by means of steam-power, but put no dams across.

There is another argument, the principal object of this letter, of an equal, if not greater weight, against such obstructions. A great number of our harbours are situated at the mouths of rivers, and the complaint of impediments to navigation from shoals and intricate channels is universal. Many harbours so situated have been long since abandoned, and to preserve others in a state at all fit for navigation, millions are annually expended, which must be set against the water privileges and neglect, as the main instruments of their destruction.

The deltas and shoals of the mouths of the Nile have been produced by the periodical and well-known overflowings of that great river, which, in bygone times, rendered Egypt almost the granary of the world; but she has lost her harbour, and what would she be now without the aid of foreign intellect and foreign capital. No need now for that wonderful Pharos, the light of all nations, to guide the vessels of the world into that noble river.

The mouths of the Danube and the Ganges are in a similar state of disorder, and should the canalization of India ever be practically carried out, an operation which will of course require numerous weirs and dams across the latter river and all its tributaries, the Hoogly, in the lapse of time, will become unnavigable except for small craft.

In the New World the tortuous and overflowing Mississippi is in a wretched state at the mouth, while the comparatively straight rivers of South America, the Amazon and La Plata, have noble entrances, unencumbered with shoals or deltas.

To come nearer home, take our own river Thames, the nation's highway, upon which millions have been, and millions more would be, freely expended, in order to improve the navigation, but to what end while the sources of evil remain undisturbed?

From Teddington lock and weir, up to the spring-head in Gloucestershire, and upon all its innumerable tributaries, there are artificial obstructions wherever available fall can be obtained. Very little has been done to confine the freshes within the respective banks, and nothing whatever has been done towards rectifying its course.

If the so-called conservators of the Thames, whoever they may be, had done their duty, the neck of the Isle of Dogs—a large portion of which is seven feet below Trinity high-water mark, would have been cut through, as publicly recommended, towards the close of the last century, and Limehouse, Greenwich, and Blackwall reaches would have been converted, at a trifling expense, into a spacious dock, of enormous area. Neither have the conservators made any attempt to lessen the obstruction of the shipping, boats, and lighters, which latter swarm both in the pool and above Bridge, by imposing a heavy tonnage duty on all cargo shipped or discharged between the banks.

The thousands of lighters obstruct the tideway at high-water, and laying with their flat bottoms on the mud during the ebb, entirely prevent the scouring action of the tidal current. Above all, they have taken no care to see that all obstructions to the free course of the river and its tributaries were gradually cleared away and abolished for ever.

Had these points received due attention, the inhabitants of the metropolis would not now be supplied with putrid water, and we should have heard little of the difficulty of getting rid of the London sewage. The ballast-heaver's trade would only have been needed for the supply of shipping, which, in point of fact, is the case at present, for the conservators will not pay for a ton of ballast got up, unless required for ballasting, while it is the boast of the ballast-heavers that, if they were paid for the work, they would very soon clear away every shoal in the river.

The cost of such an enterprise as the clearing out all obstructions to the natural flow of the Thames, involving the abolition of all water privileges, will appear rather formidable, but at least as large an amount has been expended in the various fruitless attempts to cure an incurable evil, and lost by devastating annual inundations. Be it observed also, that much larger sums have still to be expended in the vain attempt to get rid of the waste water and sewage of London, with the main arterial outfall nearly choked up and all but destroyed.

I am, &c.,
HENRY W. REVELEY, C.E.

Parkstone, Poole, Dorset, Dec. 31, 1855.

Proceedings of Institutions.

Carlisle.—The members of the Mechanics' Institute held a *soirée* in their lecture hall on Wednesday evening, the 19th ult. The attendance was numerous, and the whole of the proceedings passed off with great spirit and *éclat*. After tea the chair was taken by the Mayor of Carlisle (Dr. Elliot), who was accompanied by P. H. Howard, Esq., R. Ferguson, Esq., W. Browne, Esq., Alex. Davidson, Esq., the Rev. J. F. Simpson, and Mr. J. A. Cockburn, &c. The Mayor said, they had met to-night at the soirée of the Mechanics' Institute—an Institution which deservedly stood at the head of all the Literary Institutions in the town, and that was saying a good deal when they remembered that Carlisle boasted of about 15 or 16 in all. After speaking of the origin and progress of Mechanics' Institutions, he went on to observe that it was, perhaps, not out of place here to call attention to a proposal lately made by Government to Carlisle, inviting its municipal representatives to report as to the practicability and feasibility of establishing a Free Library. The idea of a Free Library originated, he believed, at Manchester, and there the experiment appeared to have worked remarkably well. But there was a difference between Manchester and Carlisle, which would attract attention when they came to reflect. In Manchester the number of professedly literary men was obviously much greater. The Free Library of Manchester, although the number of its volumes was very great, was not so rich in quantity as quality; and there the accomplished scholar or hard student might go with confidence to obtain books which were too expensive for him to purchase. In Carlisle probably the number of such students would not be so great as to warrant the imposition of a tax on the general community, for that was the way in which Free Libraries would have to be supported. The Mechanics' Institution was supported on the voluntary principle, and not by a tax. The Mayor then referred to the correspondence which had recently been carried on in the *Times*, between Lord Stanley and a clergyman, as to the principles on which these Free Libraries were established. The clergyman, oddly enough, maintained the greater promise of Institutions, such as we have in Carlisle, although he (the Mayor) was not aware that he was informed of our proceedings here. He believed that a greater number of small Institutions would much better answer the purposes of the general community than one large central library, however good. He (the Mayor) inclined to the same opinion, because in Carlisle the experiment had been reduced to practice, and found to work extremely well. Mr. A. Davidson, in reply to the Chairman, said, that the Institution was now in as prosperous a state as ever it was. By the last report it appeared that the number of full members was 365; and of reading members (under 21 years of age) 216; making a total of 581. The library contained 3,289 volumes, and he was glad to find that the members had availed themselves of them to a very great extent indeed. The number of volumes taken out last year was 12,558. A few years ago a much greater proportion of light reading was taken out. The number of volumes on history, biography, and science, taken out during the year was 5,767; novels, poems, and lighter literature, 5,543, and periodicals, 1,248. As to the newspaper department, it was as complete as the funds would permit. The committee had been blamed for cultivating that branch, but it had been found that every Institution in the country fell away if it did not attend to it, and the smallest Institutions now possessed their newspapers and periodicals. There was still a debt of £300 on the lecture-hall, but a certain portion of the funds were set apart yearly to liquidate it, and the receipts for letting the room were considerable. Mr. P. H. Howard was the next speaker. After congratulating the Institution upon at last possessing a room of its own, and alluding to the death of Mr. Rogers, offered some remarks on the present aspect of public affairs. Mr. R. Ferguson, with reference to what had been said as to the character of the reading in such Institutions, thought that with proper regulation and judicious selection, works of imagination were a useful and necessary part in the cultivation of the mind. The objection had arisen chiefly in the minds of those who had been familiar with the class of fictions known by the name of the Minerva Press School. This class of literature had, however, been quickly crushed. Mr. W. Browne and the Rev. J. F. Simpson followed, and Mr. Cockburn next addressed the meeting, and said, that with regard to the proposition for a Free Library, he thought that no such Institution ought to be established unless there was a manifest disposition on the part of the public not to support those already in existence. The usual votes of thanks were then passed unanimously.

London.—The Committee broke up the evening school of the London and South-Western Railway Literary and Scientific Institution, for the usual Christmas vacation, on Wednesday evening, the 19th ult., when an entertainment of tea and coffee was given to the boys. On the same evening, Mr. J. C. Brough, a member of the committee, gave a short lecture on "Combustion;" after which, the prizes awarded to the most proficient pupils were distributed. The committee invited the attendance of the parents of the boys, at the lecture and the distribution of prizes, and several were present.—A musical entertainment was given at this Institution, by Mr. Wilson, teacher of the Vocal Music Class, on Friday, December 21st, 1855. The chair was taken at eight o'clock, by Mr. F. I. Macaulay, who, in opening the proceedings of the evening, stated the concert was originated and conducted by Mr. Wilson for the benefit of the Vocal Music class. He then introduced the principal vocalists, viz., Miss Julia Bleadon, Mr. George Perren, Masters Cook and Naylor, Mr. Henshaw, Mr. Paul Jerrard, accompanist, and the conductor, Mr. Wilson. The concert commenced with Balfe's opera, "The Bohemian Girl" (by the kind permission of Mr. Bunn), and the several parts of *Count Arnheim*, *Thaddeus*, *Devilshoof*, and *Arline*, were ably sustained by Mr. Henshaw, Mr. Perren, Mr. Wilson, and Miss Bleadon respectively, who greatly pleased a large audience with their performance of the beautiful music of the opera. The second part consisted of miscellaneous music, including Sir H. Bishop's music in "Guy Mannering." Some of the pieces in this opera, and also several of the songs in the "Bohemian Girl," were favoured with *encores*. Mr. Macaulay announced a lecture on the "Seasons of the Year," by Mrs. Balfour, on the 27th December, 1855; also, that by arrangements kindly made by Mr. Crombie, the president of the Institution, Mr. Bunn will, on the 17th January, 1856, give his popular entertainment, entitled "A Visit from John to Jonathan," and expressed a hope on the part of the committee that the members and their friends would largely take advantage of these opportunities of hearing those celebrated lecturers. A vote of thanks to Mr. Wilson and his assistants concluded the proceedings of the evening.

POPLAR AND LIMEHOUSE.—On Tuesday, the 18th ult., Mr. J. Bennett, F.R.A.S., gave a lecture at the Literary Institution, "On the History and Construction of Clocks and Watches." It would be impossible that the somewhat dry subject of horology could be brought before a popular audience in a more simple or attractive manner. In his hands wheels, pinions, pendulums, escapements, and balances, assumed a charm which they never seemed to have before. His rapid glance at the history of chronometers could not fail to interest those who owe so much to maritime enterprise and success. His explanations of the mechanism of clocks and watches, especially the principle of compensation in the pendulum and balance-wheel, were clear and easily understood; and his graphic sketch of a visit to the watch-making district of Switzerland evinced close observation of men and manners, and not only amused his hearers, but must have awakened serious reflection with respect to the social state of our own working classes. On the whole, Mr. Bennett both pleased his audience, and sent them away with an intelligent idea of that little monitor which most men carry in their pockets, and continually consult, but of which generally they have as vague a notion as had the Highlander, who, having found a gold watch upon the field of battle, when after some hours it had run down, flung it away with contempt, exclaiming "She died last night." A watch, after listening to Mr. Bennett's lecture, no longer seems a complicated and inexplicable maze of wheels, but a very simple and beautiful piece of mechanism, upon which a marvellous amount of genius and application has been employed before it reached its present state of perfection.

To Correspondents.

BYE-LAWS OF INSTITUTIONS.—As the Committee of the Sheerness Mechanics' Institution are about revising the Bye-laws of that Society, they would feel obliged by any Institution in Union transmitting copies of such as may have been found to answer satisfactorily.

MEETINGS FOR THE ENSUING WEEK.

MON. London Inst., 7, Mr. C. C. Clarke, "On the Genius and Comedies of Molière."
Entomological, 8.
TUES. R. Inst., 3, Prof. Faraday, "On the Common Metals."
Syro-Egyptian, 7½, Rev. Dr. Hewlett "On the Sarcophagi of Egypt."
Civil Engineers, 8, Mr. R. K. Hall, "On the Causes of the Explosions in Steam Boilers."
Med. and Chirurg., 8½.
Zoological, 8.
WED. Literary Fund, 3.
London Institution, 3, Mr. Robert Grant, "On Elementary Astronomy."
Society of Arts, 8, *Extra-Ordinary*, Mr. J. K. Blackwell, "The Present Position of the Iron Industry of Great Britain, with reference to that of other Countries." Part II.
Graphic, 8.
Geological, 8, I. Mr. H. C. Sorby "On the Physical Geography of the Tertiary Estuary of the Isle of Wight;" II. Mr. E. W. Binney, "On the Permian Rocks of the South of Scotland."
Roy. Soc. Literature, 8½.
THURS. London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.
FRI. Astronomical, 8.
Philological, 8.
SAT. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette December* 21*st*, 1855.]

Dated 7th December, 1855.

2768. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron.
2770. Charles Edmund Green, 13, Blandford-street, Portman-square—Improvements in huts, tents and camp hospitals.

Dated 8th December, 1855.

2772. Joseph Hacking, Bury—Improvements in machinery for supplying fuel and air to furnaces.
2774. John Radcliffe and Thomas Vickers Favell, Rotherham—Improvements in machinery or apparatus for cutting sugar and other substances.
2776. Andrew Tevendale, 2, Wellington-buildings, Vauxhall-road, Liverpool—Improvements in propelling, and in the construction of, steam or other vessels.
2778. Andrew Maclure, 37, Walbrook—Improvements in lithographic printing-presses.

Dated 10th December, 1855.

2782. Thomas Heppleston, and John Hunter, Manchester—Improvements in machinery or apparatus for stretching and finishing yarns or threads.
2784. David Parsons, Pensnett, near Dudley—Improved brake for arresting or retarding at will the motion of locomotive and other engines and revolving machinery.
2786. Richard Archibald Brooman, 166, Fleet-street—Improvements in manufacturing gas from peat, and in treating hydrogen gas, in order to render it illuminating. (A communication.)
2788. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvements in connecting earthenware rain pipes and soil pipes of water-closets, and in valve water-closets.

Dated 11th December, 1855.

2790. Bernard Hughes, Rochester, New York, U.S.—A machine for making spokes and tool handles. (A communication.)
2794. Alexander Tolhausen, 7, Duke-street, Adelphi—Improvements in mariners' and land compasses. (A communication.)
2796. James Cliff, Burton-on-Trent—Improvements in or additions to furnaces.
2798. Reuben Levy, Manchester—Improvements in wearing apparel.
2800. René Simon Bouet and Henri Emile Isidore Douein, Paris—Improvements in the preservation of meat and other animal substances serving for food.
2802. Alexandre Forot, Paris—Improvements in parasols.
2804. Rogers Ruding, 51, Bunhill-row—Improvement in printing silks and other woven fabrics with gold and other metal leaf or powder.

Dated 12th December, 1855.

2806. Martin Billing and Walter George Whitehead, Birmingham—Improved waterproof fabric or material.
2808. George Heron Hay and David Syme Hay, Edinburgh—Improvements in photographic pictures.
2810. William Leighton, Newcastle-upon-Tyne—Improvements in paddle-wheels.
2812. Thomas Rickett, Stony Stratford—Improvements in pressure-guages.

Dated 13th December, 1855.

2814. David Hart, Trinity-square—Improvements in signalling or communicating between parts of a railway train, and in the instruments and apparatus employed for such purpose.
2816. Alphonse Louis Poitevin, Paris—Improved photographic engraving.
2818. George Skelton, Lambeth—Improved projectile.
2820. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for containing and distributing aeriform fluids under pressure. (A communication.)
2822. George Hall Nicoll, Dundee—Improvements in fire-places or heating apparatus.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2835. Ebenezer Rogers, Abercarn—Improvements in safety doors for mines.—15th December, 1855.
2880. Dundas Smith Porteous, Paisley—Regulating the pressure of gas, steam, water, or other fluids.—20th December, 1855.

[*From Gazette December* 28*th*, 1855.]

Dated 9th November, 1855.

2520. John and William Olive, Woolfold, near Bury—Improvements in the manufacture of wheels for railway and other purposes.

Dated 17th November, 1855.

2596. Joseph Shaw, 22, New King-street, Hull—Improvements in the prevention of accidents arising from collisions on railways.

Dated 23rd November, 1855.

2643. John Henry Hutchinson, East Retford—Improved machinery for converting rectilinear motion into rotary motion.
2645. John Jobson, Litchurch, Derby—Improvements in the manufacture of railway chairs.

Dated 24th November, 1855.

2649. Jean Lobstein, Paris—Improvements in sewing machines.
2651. Robert Knowles, Chorlton-upon-Medlock—Improvements in winding on in certain machines for spinning cotton and other fibrous materials.
2653. Charles Sanderson, Sheffield—Improvement in the manufacture of iron.

Dated 26th November, 1855.

2655. Louis Joseph Fredéric Margueritte, Paris—Improvements in precipitating certain salts.
2657. John Wilkes, Birmingham—Improvements in the manufacture of tubes of copper and alloys of copper.
2659. François Coignet, 90, Rue Hauteville, Paris—Improvements in the use and preparation of plastic materials or compositions to be used as artificial stone, or as concrete or cement for building and other purposes.
2661. Frederick Osbourn, Aldersgate-street—Improved machinery for pressing, smoothing, or finishing garments or parts of garments.
2663. John Julius Clero de Clerville, Newman-street, Oxford-street—Improvements in preparing oil with other matters for painting. (A communication.)
2665. Robert Bell, 93, Glassford-street, Glasgow—Improvements in the manufacture of woven fabrics when made of wool and cotton, or of wool, cotton, and silk.

Dated 27th November, 1855.

2667. William Edward Newton, 66, Chancery-lane—Improvements in breech-loading fire-arms. (A communication.)
2669. Hiram Hyde, Truro, Nova Scotia—An improved manufacture of lubricating oil. (A communication.)
2671. Charles Rice, Massachusetts, U.S.—Improved method of manufacturing boots or shoes. (A communication.)
2673. Charles Rice, Massachusetts, U.S.—Improved process of preparing cloth so as to render it nearly, if not entirely impervious to water, but not so to air, such cloth being particularly useful in the manufacture of boots and shoes, or various other articles of dress or utility. (A communication.)
2675. George Louis Stott, St. George's, Gloucester—Improvements in the manufacture of carbonate of soda.
2677. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in windlasses, capstans, and other purchases, parts of which are applicable to the transmission of motive power. (A communication.)
2679. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture or preparation of india rubber and gutta percha, and in the applications thereof. (A communication.)
2681. George Richardson, Craig's-court, Charing-cross—Improvements in chain cables and other chains. (A communication.)

Dated 14th December, 1855.

2824. William Philippi, 159, Regent-street—Improvements in coating iron with tin.
2826. George Tomlinson Bousfield, Sussex-place, Loughborough-road—Improvements in machinery for the manufacture of cut pile fabrics. (A communication.)
2828. Edward Orange Wildman Whitehouse, Brighton—Improvements in apparatus for measuring fluids.

Dated 15th December, 1855.

2830. William Henry Newman, 45, Cannon-street-road—Improved fire-lighter.
2832. Thomas Warren, Glasgow—Improvements in the manufacture and moulding or shaping of glass.
2834. Edward Brown Hutchinson, Moorgate-street—Improved apparatus for forming and cutting elliptical figures.
2840. Samuel Stewart, 28, Clements-lane—Improved combined engine and gas exhauster, and also improvements in the valves of such exhausters.
2842. Paul Marie Salomon, Rue Neuve, St. Eustache, Jacques Loir Montgazan, Rue de Bondy, and Charles Marie Joseph de Flers, Rue Lafitte, Paris—Improvements in the manufacture of gas from coals, and in the production of bituminous coke in that manufacture, and also in the apparatus connected therewith.

Dated 17th December, 1855.

2844. George Collier and John Crossley, Halifax, and James William Crossley, Brighouse—Improvements in apparatus employed in drying and stretching woven fabrics.
2846. Henry Stewart, Baker-street—A machine or apparatus for cleaning and polishing forks, spoons, and other liked curved articles.
2848. Omrod Coffeen Evans, M.D., New York—Improvements in digging machinery.
2850. George Gotts Golding, Gray's-inn-road—Improvements in boilers for heating, warming, or raising steam.
2852. James Leitch, 1, Ellenborough-street, Liverpool—Improvements in filtering sugars and other saccharine matters.
2854. Jean Jaques Fontaine, Paris—Improvements in the manufacture of steel.
2856. Andrew Small, Glasgow—Improvements in marine compasses and in apparatus applicable thereto.

WEEKLY LIST OF PATENTS SEALED.

Sealed December 21st, 1855.

1423. Jacob Ben'Jamin.
1441. Thomas Walker.
1443. William Pearce.
1445. Ignace Joseph Silbermann.
1457. James Ronald.
1459. Benoit Bonnet.
1471. Henry Walker.
1473. Charles Moreau-Darluc.
1483. Edward Joseph Hughes.
1484. Jean Baptiste de Lorenzi.
1491. Thomas Barling.
1510. Joshua Horton and Thomas Horton.
1518. Anguish Honour Augustus Durant.
1530. Richard Roberts and George Coppock.
1549. Edmund Hart.
1586. Thomas Sadleir.
1628. Pietro Bertinetti.
1685. George Tomlinson Bousfield.
2079. William Frederick Thomas.
2117. John Henry Linsey.
2151. Henry Hughes.
2245. John Henry Johnson.
2253. James Murdoch.
2324. William Henry Walton.
2366. Alfred Gregory and John Jillings.
2394. Frederick Crace Calvert.

Sealed December 28th, 1855.

1479. John Skelley.
1485. Henri Dembinski.
1487. John Broadbent and Stanley Peter Youle.
1489. John Weems.
1493. John Birch.
1499. Robert Muckelt.
1509. Samuel Oddy.
1515. James Bullough, Robert Willan, and John Walmsley.
1520. James Beckett and William Seed.
1522. John Gedge.
1539. James Palmer.
1555. Charles Frederick Bielefeld.
1559. John Bethell.
1585. Francis Hamilton.
1598. Pierre Laroche.
1613. Charles Toye.
1615. Thomas Trapp.
1629. David Fisken and Thomas Robert Hay Fisken.
1633. John Henry Johnson.
1634. John Henry Johnson.
1635. John Henry Johnson.
1642. John Henry Johnson.
1658. James Tildesley.
1729. William Fletcher Coles.
1734. Herbert Mackworth.
1827. Walter Brown.
1992. William Armand Gilbee.
2003. William Armand Gilbee.
2196. Richard Threlfall and William Knowles.
2199. William Edward Newton.
2208. John Dickinson.
2215. Henry Cornforth.
2358. William Teall.
2432. Alfred Vincent Newton.
2468. Fennell Allman.
2482. Peter McGregor.

Sealed January 1st, 1856.

1494. William Henry Tooth.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

December 17th.

1093. William Wilkinson.
1100. William Robertson.
1116. George Gwynne and George Fergusson Wilson.
1147. George Gwynne and George Fergusson Wilson.
1170. George Fergusson Wilson.
1171. George Gwynne and George Fergusson Wilson.

December 21st.

1149. Jean Louis David.
1202. James Ward and William Burman.

December 22nd.

9. Matthew Tomlinson.

December 24th.

1172. John Mason.
1174. William Beckett Johnson.
1197. Auguste Edouard Loradoux Bellford.

December 26th.

1185. Francis Alton Calvert.

December 27th.

1182. James Webster.
1183 Claude Joseph Edmée Junot.
1206. Robert Taylerson.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3798	December 21.	Improved Vegetable Cutter..................	Page and Gurling..............	Melton, Suffolk.
3799	„ 31.	Fore Carriage for Perambulators	James Clifton	541, New Oxford-street.
3800	January ...1.	Chair	Thomas Pinfold Hawkins...	Birmingham.

Journal of the Society of Arts.

FRIDAY, JANUARY 11, 1856.

NOTICE TO INSTITUTIONS.

A meeting of representatives from Institutions in the neighbourhood, or within easy access of London, has been fixed to be held at the Society's House, John-street, Adelphi, on Friday, the 18th of January instant, at 6 p.m., to confer with the Council on the best means to be adopted for practically giving effect to the Society's scheme for the examination of members of classes, for the promoting of the formation of classes, and to discuss whether any or what steps are desirable to be taken in reference to lectures. In inviting to this meeting a section only of the Institutions, the Council has had in view simply their convenience, and with no desire to exclude any; on the contrary, the Council will be glad to have the attendance of representives from any Institution in Union, whether near or distant.

The Institutions proposing to send representatives to this meeting, are requested to forward to the Secretary of the Society of Arts, a few days previous to the meeting, the names of those who will attend on their behalf. It is to be understood that this meeting is not to be considered as a formal conference, but simply in the light of a committee meeting.

EXTRA-ORDINARY MEETING.

Wednesday, January 9, 1855.

An Extraordinary Meeting was held on Wednesday evening, the 9th inst., Joseph Glynn, Esq., F.R.S., in the chair, for the purpose of receiving and discussing the following paper:—

THE PRESENT POSITION OF THE IRON INDUSTRY OF GREAT BRITAIN, WITH REFERENCE TO THAT OF OTHER COUNTRIES.

SECOND AND CONCLUDING PART.

By J. Kenyon Blackwell, F.G.S.

The ores of iron must be separated from the carbonic acid or water with which they are associated before their reduction can be effected. This separation is produced by calcination, either in the open air or in the chamber or furnace in which reduction takes place, but, whatever the original state of the ores may have been, in examining the nature of the re-actions which produce their reduction, they must be regarded at the period immediately preceding it, as oxides, either mixed with various substances as impurities, or, perhaps, as the temperature to which they are subjected is increased and deoxidation proceeds, entering into chemical combination as silicates before perfect reduction is completed.

In all processes employed in the manufacture of iron, the re-agent by which the reduction of the ore is effected is carbon. It is essential in all chemical re-actions that there should be intimate contact of those bodies between which this reaction takes place. One at least of any two solid bodies entering into this relation must therefore be brought in the first instance into the liquid or gaseous state. Between two solids the number of points of contact is, under any circumstances, infinitely small, but it is otherwise when one of the bodies concerned is in a liquid or gaseous state. The researches which have been made into the nature of the gases of the blast furnace, have proved, what might have been predicated from theory, namely, that carbon in its gaseous state, as oxide of carbon, is the reducing agent by which the ores of iron are brought into the metallic condition.

The processes of reduction by carbon of the metallic oxides may be divided into two classes, in both of which however the oxide of carbon is the immediate re-agent. These two classes of procedure, in which the oxide of carbon is obtained in two different modes, are those of cementation and the blast furnace; using the latter term in its correct signification as embracing all those furnaces in which a current of air entering the furnace under pressure and passing through the materials contained in it is employed.

The first class of procedure, that of cementation, is characterised by the following conditions, namely, the oxygen necessary for the production of the oxide of carbon is essentially furnished by the metallic oxide to be reduced, and the heat necessary for this reduction is produced without the vessel or chamber in which the cementation is effected, and independently of the chemical re-actions which produce the oxide of carbon.

In the second class, that of the blast furnace, the oxygen necessary for the formation of the oxide of carbon is supplied by a current of atmospheric air, and the heat required in the process is developed in the furnace itself, by the re-actions necessary to produce the oxide of carbon which forms the reducing agent.

It will, therefore, be observed, that the blast furnace is essentially by its nature, at the same time both more simple and more energetic in its operations than any method for reducing ores by cementation can be. The heat required in the reduction of the ore is developed in the chamber itself in which the reduction is effected, by the mutual action of the re-agents employed, instead of being produced externally, and, therefore, at a great disadvantage. In the blast furnace, the addition of a flux to the ores treated permits the elimination of the impurities present, which cannot be effected in cementation except in those cases in which the metal itself is volatilized.

Cementation is, therefore, a process of reduction applicable to those metals only, the oxides of which part with oxygen and become fluid at a low temperature, and are themselves volatilized by a small accession of heat.

In the treatment of ores of iron, which retain the oxygen with which they are combined with strong affinity, even at the highest temperatures, except in the presence of a powerful re-agent, and which in the metallic state acquires only in the peculiar condition of carburet, sufficient fluidity to permit its complete separation from the earthy matters with which this metal is associated to a greater or less extent in all its ores, the blast furnace must always continue to retain the position which it now occupies as the only practicable method of reduction.

The term *blast furnace*, in its correct meaning, properly includes all furnaces in which the reduction of metallic oxides by the oxide of carbon is effected through the re-actions produced at an elevated temperature by the agency of a current of air forced under pressure into the mass of ore, flux, and fuel subjected to its action.

These furnaces, therefore, must be subdivided into two classes; the type of one will be found in the low and open Catalan hearth; of the other in the high and closed blast furnace, now in general use for smelting. Conformably to the somewhat erroneous practice in this country, the latter class of furnaces is that which will be spoken of in this paper as the blast furnace.

The reduction of the ores of iron in the Catalan hearth, and in other furnaces which are modifications of that class, is necessarily imperfect. A part only of the oxides introduced into the furnace are reduced to the metallic state, while another large part is lost in the formation of silicates of iron for the purpose of carrying off in fusible slags the various impurities contained in the ores.

In the elevated blast furnaces now generally used for smelting, the oxide of carbon formed in the lower part of the furnace is continually renewed after its successive re-actions, from being propelled through the superincumbent incandescent carbon by the current of atmospheric air continually entering the furnace through the tuyeres. By this continually renewed action, the whole of the oxides of iron subjected to its influence may be entirely deoxidised, and finally, by the carburising action exerted in the lower regions of the furnace, reduced to a fluid state, while the earthy matters contained in the ores pass off in vitreous slags, separated by their different specific gravity.

The current of atmospheric air forced into the lower part of the blast furnace, carries with it in its transit almost the entire quantity of the carbon introduced, the oxygen of the ores, the carbonic acid of the limestone, when used uncalcined, and, lastly, the water present, either accidentally or in a combined state, in the coal, cokes, charcoal, or minerals.

At a short distance above the tuyeres the oxygen of the air is completely transformed into carbonic acid. At a somewhat higher point this carbonic acid is reduced into carbonic oxide by the acquisition of a further quantity of carbon. From this place the nature of the gaseous current in the blast furnace is not found to vary in its character for a considerable distance upwards, the presence of incandescent carbon in excess converting instantaneously into carbonic oxide, the oxygen abstracted by the ascending current from the descending reduced oxides.

Above this point, which in furnaces of the usual form appears to be near the top of the boshes or widest part of the furnace, the deoxidation of the ore continues rapidly. Notwithstanding the greater width of the furnace, the consequent diffusion of the gaseous current, and its slower rate of ascent through the materials from this point, it exhibits rapid modifications in its character in its progress upwards. The abstraction of oxygen from the ores continues, and the transformation of carbonic oxide into carbonic acid, which is the result, remaining from this point in part unreduced, on account of the decreasing temperature of the furnace, the proportion of carbonic acid continues rapidly to augment. At some distance below the mouth of the furnace the volume of this gas becomes again stationary, the deoxidising re-actions having ceased. The only increase which it receives in this part of the furnace is from the carbonic acid of the uncalcined limestone.

The hydrogen gas found in small quantities in the lower regions of the blast furnace results from the water contained in the air introduced. Its quantity is found to continue uniformly augmenting during the ascent of the gaseous column upwards throughout the furnace, from the hydrogen still retained in the fuel, and also from the decomposition of the water which remains both in the minerals and fuel. In the upper part of the furnace some water from these sources is found to be present as steam.

It would appear, from the slow but constant augmentation of the hydrogen forming part of the gaseous current, throughout its ascent in the blast furnace, whilst water as vapour only exists within a short distance below the level of the mouth, that this gas exerts no influence as a deoxidising agent. The reduction of the ores results, therefore, solely from the ascending column of carbonic oxide.

The nitrogen contained in this atmosphere of heated gases not being capable of exerting any species of re-action on the materials of the blast furnace, remains unchanged and constant in its quantity, from the tuyeres to its exit at the mouth of the furnace. The quantity in which it is present in the ascending gaseous column at any given point, therefore, becomes a convenient datum for reference, by which the changes in the other variable constituents can be determined, and the nature of the re-actions which they indicate ascertained.

The knowledge of the changes which take place in the interior of the blast furnace, and, approximatively, of the limits within which those changes occur, enables us to determine with considerable accuracy the most suitable outline to be given internally to furnaces of this description.

The internal form of these furnaces commonly adopted, consists essentially of two frustrums of cones meeting each other at their bases, at the point where the widest part of the furnace, forming what is technically called the top of the boshes, is situated. From this point the furnace gradually contracts both upwards to its mouth, and downwards to the level of the tuyeres below. The hearth, properly speaking, is that part of the furnace only which receives the fluid metal and cinder as they fall below the level of the tuyeres. It forms a short prolongation from that point of the lower inverted cone.

The diameter of the furnace in its widest part above the boshes ought to bear a fixed relation to the diameter of the hearth at the tuyeres, the total height of the furnace, and the volume of blast which is to be introduced. The height of the furnace depends on the nature of the materials to be smelted. The ordinary practice has been to give furnaces dimensions in this part totally out of proportion to the size of the hearth. That part of the furnace where the greatest width occurs, ought to be situated higher, relatively to the total height of the furnace, than it is usually placed. From this point the interior ought to contract downwards (not suddenly, nor in any one place at a greater angle of inclination than at another), to the level of the tuyeres, the diminution in size being exactly in proportion to the gradually decreasing bulk of the descending materials, in the ratio of their reduction in volume, from the absorption of the carbon by the ascending blast, and the descent into the hearth of the liquified ores and flux.

As the reduction in volume of the materials in the blast furnace is everywhere gradual, from the point where the carbon with which they are interstratified commences to be volatilised, and the ores commence to fuse and unite with the limestone, it is evident that the diminution in the sectional area of the blast furnace from its widest part downward toward the tuyeres ought to be equally gradual, and in the same ratio. When any departure from this rule occurs, by lowering and flattening the boshes, and by prolonging the narrow dimensions of the hearth above the tuyeres, it is evident that all those materials which are situated near the outer part of the furnaces must be arrested in their descent, and that the central portion will have a tendency to subside more rapidly than the exterior, whereas, when the sectional area of the blast furnace is contracted only in the ratio of the diminution in volume of the descending materials, the whole of the burden of the furnace must subside uniformly, without any one portion of it out-running the other.

If that part of the blast furnace commencing at the point where it attains its greatest width, were continued of the same wide dimensions upwards to its mouth, two objectionable results would ensue; first, the upper part of the furnace would be cooled by the too rapid dispersion of the ascending column of heated gases, and by the entire absence of the reverberating effect of the contracted mouth; and secondly, the materials could not be equally spread from the filling holes over so wide a surface. The diameter of the upper part of the furnace ought, therefore, to be such as will cause the materials thrown in at the filling-holes to distribute themselves equally in their descent over every part of the sectional area of the furnace, and will produce such a reverberation only of heat as shall be sufficient to expel the water and carbonic acid contained in the materials, without consuming any of the carbon of the fuel; this ought to remain intact until it reaches the lower regions of the furnace, where it is vaporised as carbonic oxide, and produces the re-actions on which the reduction of the ore depends.

It is, therefore, evident that the dimensions of the mouth of the blast furnace ought to be sufficiently large to prevent the waste of fuel which may be produced from the reverberating effect of a narrow top, whilst they are sufficiently contracted to prevent a too rapid dispersion of the heated gases; at the same time, the filling apertures which surround the mouth ought to be in such positions, relatively to the mass of materials contained in the furnace below, as to produce an equable distribution of those materials by spreading them, as they fall, both towards the outside and towards the centre of the furnace. It has been found in practice that a diameter of the mouth of the blast furnace somewhat greater than half of its largest dimensions above the boshes is such as accomplishes both these objects.

Below the level of the filling apertures the sectional area of the blast furnace should regularly enlarge, increasing somewhat rapidly to its widest diameter. This, as already observed, ought to be at that point where the reducing re-actions of the blast furnace commence. The full width of the furnace ought to be prolonged downward to some distance below this limit, because the re-actions of the furnace at their commencement, before the fusion of the ore and limestone takes place, produce little change in the volume of the materials subjected to their action; and it is desirable that the materials should be spread over a wide sectional area, through which they will descend slowly, exposed to the deoxidising current of ascending gases, according to their different specific gravities or state of solidity or fluidity.

The proposition laid down by some of the principal writers on the theory of the blast furnace, namely, that the materials in it, which possess very different specific gravities, descend through the furnace in the same distinct strata as those in which they are spread when introduced at the mouth, is entirely erroneous. Their descent is in vertical lines, moving parallel to each other at different rates, according to their different specific gravities; and this species of motion produces a perfect intermingling of the whole. The internal outline of the furnace ought to be such as not to interrupt this motion in any part of the descending column, nor by a too rapid contraction of the sectional area of the furnace to arrest the outward portions of the materials, while the internal portions, situated vertically above the hearth, leave the others behind in their passage downwards.

It is, therefore, evident that the point where the diminution in the sectional area of the blast furnace commences downwards, below that where its greatest dimensions have been attained, ought to be that where the volatilisation of carbon commences; and that the blast furnace ought to diminish in sectional area in the exact proportion that the carbon of the burden decreases in volume, increasing as the liquefaction of the ores and flux, and the rapid descent of this part of the materials into the hearth, causes an increasing diminution in the bulk of the descending materials.

Other circumstances being equal, the sectional area of the blast furnace hearth at the level of the tuyeres forms the measure of the amount of blast which will enter the furnace, and this again determines its smelting power. The only necessary limit to the size of the blast furnace hearth will be found in the power of the blast to penetrate equally the materials with which the hearth is filled, from the tuyeres externally, to its centre.

The height of the blast furnace depends on the length of the transit downwards exposed to the reducing atmosphere of the ascending current of gases which is necessary to produce the perfect reduction of the ores smelted. With refractory ores the body of the furnace above the tuyeres ought to be higher and narrower, than when easily-reducible ores are used, the dimensions of the hearth itself remaining in each case the same.

In furnaces blown with heated air, the re-action of the oxygen of the blast on the carbon contained in the furnace is much more rapid than when cold air is used. In cold-air furnaces, there is a zone of considerable height in proximity to the tuyeres in which an oxidising and decarbonising action is exerted by the blast. In the hot blast furnace the height of this zone is greatly diminished. Practically it seems to disappear.

From the more rapid re-action of heated than of cold air on the carbon contained in the blast furnace, the temperature of the lower part of hot-blast furnaces is greatly augmented; at the same time, the reducing gases required to deoxidise the descending minerals are produced in greater volume at a lower level in the furnace. From these causes the height of furnaces blown with hot air is not necessarily so great as that of those in which cold air is used.

The reduction of the minerals in the blast furnace takes place by the action of the blast proceeding from the circumference of the furnace towards the centre. The ascending current of reducing gases impelled by the blast, but met by the counteracting pressure of the descending materials, finds the easiest channel for its ascent near the exterior of the furnace, at the same time that its velocity forces it towards the centre. It is desirable that the dimensions of the furnace should be such as to produce the equal diffusion of these gases through the whole body of desending materials.

The analyses which have been made of the gases of the blast furnace, show that only about one-third in volume of the oxide of carbon produced in the blast furnace is utilised before its escape at the mouth.

It has already been observed, that before the reduction of the ores smelted in the blast furnace can take place, the water and carbonic acid which they contain must be expelled. This must be effected either by calcination in the open air, previous to their introduction into the furnace, or in the furnace itself. When this calcination takes place in the blast furnace, it must result in a considerable diminution of the heat of the furnace; but since, along with the escaping uninflamed gases, there is also a large amount of surplus heat in the gaseous current, this may be, to a certain extent, utilised for their calcination, without any apparent loss of fuel in the furnace. This practice of calcination in the furnace, even to a limited extent, can, however, only be admissible when the waste gases are not utilised by combustion for other purposes.

The preliminary calcination of the limestone employed as flux in smelting before its introduction into the blast furnace would, undoubtedly, produce some economy in fuel.

The fuel employed in the reduction of ores in the blast furnace possesses this reducing power only in respect of, and in proportion to, the carbon which it contains. Whether, therefore, it be wood or coal, the question regarding its employment in the raw state, or partially or wholly carbonised, rests solely on the circumstance whether it can be more perfectly and economically carbonised in the open air, in closed ovens, or in the blast furnace itself.

The differences in the chemical nature of the various elements, forming on the one hand vegetable, and on the other mineral fuel, are only in degree, and not in kind, except in so far as regards the composition of the earthy residuum of ashes left after the volatilization of the other elements. It may, therefore, be in the different nature of the substances present in the ashes of wood and of coal that we must seek for the explanation of the causes which produce such a widely different quality in iron smelted with these two species of fuel. Sufficient attention has not hitherto been paid to the ascertaining of the exact nature of the diversities in the composition of this portion of the constituents of wood and coal, and of different varities of coal.

The mechanical operations by which a large part of the earthy impurities of all coal seams of a caking nature might be separated from them before they are converted into coke, have been hitherto generally neglected in this country.

Abstraction being made of these variable constituents (a large part of which are only present in coal as impurities), no distinct line of demarcation, founded on the chemical nature of the two bodies, can be drawn between wood on the one hand and coal on the other. Both are composed essentially of carbon, hydrogen, oxygen, and nitrogen. Oxygen is present in the largest quantity in wood, while its proportion is lowest in the most highly mineralised, or anthracite coal.

The whole of the combustible bodies of this nature range themselves in one general series, the different classes of which may be divided into the following seven species, in accordance both with the physical characters which they exhibit, and at the same time their greater or less degree of oxygenisation; namely, wood; lignite; cannel, or splint coal; non-caking coal, yielding a long flame; caking coal; non-caking coal, yielding a short flame; and lastly, anthracite.

It has already been observed, that the fuel employed in the blast furnace possesses a reducing power only in proportion to the quantity of carbon which it contains, and that the question whether this fuel ought to be used in its raw state or carbonised, and whether the coke or charcoal into which it must be converted should be prepared in open fires or in close ovens, depends solely on the quantity and quality of the coke or charcoal which will be obtained from it, by these various systems, and the comparative economy with which they can be prepared.

Those species of coal which it has been found most easy to employ in the blast furnace have been the non-caking varieties. Caking coals require to be mixed with coke to a greater or less extent, to prevent the adhesion of the whole of the fuel in one mass.

Notwithstanding the great extent to which raw coal and partially torrified wood have been long used in the blast furnace, both in this country and abroad, it certainly appears, on a careful consideration of the nature of the process to which both coal and wood must be subjected, either within or out of the blast furnace, before the carbon which they contain can be utilised in the reactions of the furnace, that their carbonisation may be effected with most economy, and that the quality of the charcoal or coke which results from this process will be best, when effected in closed ovens, prior to the introduction of the fuel into the blast furnace, and not within the furnace itself.

When wood or coal are coked at a low temperature, the hydro-carbon products, which carry off a large quantity of carbon, are formed much more abundantly than when this operation is conducted at a high temperature. Under the influence of high temperature, the hydrogen of these substances passes off either alone or in its proto-carbonated state. If wood or coal are coked in closed ovens, the degree of heat to which they are subjected in that process, and its duration, which is necessary to harden the product, can be controlled. When this operation takes place in open fires, or in the blast furnace itself, these two conditions cannot be regulated with the same facility, nor can the supply of oxygen to the incandescent carbon be determined with the necessary exactitude to limit its supply simply to that necessary to obtain the requisite temperature. The form adopted in the construction of the coking oven is an important element in obtaining the requisite temperature.

Coal and wood not only give the highest yield in coke and charcoal, when their carbonisation is conducted at an elevated temperature, but they are found to be superior in quality, and better fitted for use in the blast furnace, when they have been subjected for a considerable time to the action of this elevated temperature than when they have been coked rapidly at a low heat. It is, moreover, important that the temperature to which they are subjected should be raised to its highest point as soon as possible after the carbonisation commences. These necessary conditions can only be obtained by coking in close ovens.

The system of coking in close ovens possesses another advantage, in permitting the utilisation of the heat afforded by the combustion of the waste gases of the coal, in the raising of steam. Many of the largest continental works derive the whole of their supply of steam from boilers set over their coke ovens.

The separation of the iron in a metallic state from the earthy matters and impurities contained in its ores is effected most perfectly in the blast furnace when the heat of the furnace is sufficient to produce at least a medium degree of carburation in the iron, and when there is a sufficient amount of lime present as flux to produce a fluid cinder. White or imperfectly carburised iron usually contains the whole of the sulphurets of the ores, and probably variable quantities of unreduced oxide, and of the earthy matters contained in the ores, mechanically mixed with it; at the same time the heat of the furnace not being sufficient to effect a perfect reduction of the ore a large quantity of oxide passes into the slag in the state of silicate. In this country, in South Wales especially, very large losses are constantly sustained by the ironmasters by this imperfect smelting.

The oxide of manganese, found in larger or smaller quantities in almost all ores of iron, is to a great extent reduced in the blast furnace, and passes into the pig iron. It is partially or wholly removed by oxidation in the subsequent processes of the refining and puddling furnaces.

An elevated temperature in the blast furnace has a tendency to reduce a portion of the silica contained in the ores to a metallic state, when it enters as an alloy into the crude iron. The same cause appears to act to a minor degree in producing to a small extent the reduction and alloy of other bodies present in the furnace; but silicium and other metals of this class are entirely, or in great part, eliminated in the subsequent oxidising processes of the refining and puddling furnaces.

The sulphurets of iron contained in the ores of that metal, and often, even more largely, in the mineral fuel used in its reduction, are partially, but not wholly, decomposed in the blast furnace. An elevated temperature and the presence of lime aid this decomposition, and the elimination of the sulphur as sulphuret of calcium.

The phosphate of iron contained in these ores is reduced to the state of phosphuret in the blast furnace, and passes entirely into the pig-iron. This substance has been found, but only rarely, in furnace slags as phosphate of alumina; it may possibly have existed in that combination in the ore previous to smelting. The phosphuret of iron which is reduced in the blast furnace is again subjected to oxidation in the refining and puddling furnaces. It passes partially or wholly into the slags, which are separated in those processes.

Much controversy has taken place with respect to the difference in quality supposed to exist between pig iron smelted with cold and with hot blast. While no doubt could exist with respect to the economy of fuel, the greater regularity in the action of the blast furnace, and the larger quantities of metal obtained under equal circumstances by the use of the hot blast, it has generally been considered that the pig-iron smelted with hot was inferior in quality to that produced with cold air. Undoubtedly, this opinion has been created to a great extent from ignorance of the facts of the case. Furnaces blown with heated air exert greater reductive power than those in which a cold blast is used. This has led, since the introduction of hot blast, to the extensive usage in iron smelting of refractory ores not formerly smelted, a large part of which have been ores of a class calculated to produce inferior iron; and it is from the use of ores of this nature, far more than from any deterioration in quality arising from the use of a heated blast, that this opinion has originated.

At the same time it appears to have been proved that the more elevated temperature of the hot blast furnace has a tendency in a slight degree to increase the quantity of silicium and other cognate metals which form alloys with pig-iron in the smelting process. Phosphuret of iron is said to have been found to a minutely increased extent in combination with pig-iron smelted by hot air when compared with that obtained from the same minerals by cold blast. On the other hand the sulphurets of iron appear to be removed to a greater extent by the agency of hot air. The subsequent oxidising processes in the conversion of pig into wrought iron eliminate in part, or wholly, these foreign metals as oxides, and the phosphuret of iron as phosphate, in the slags produced.

The essential nature of the process of reduction in the blast furnace, by a deoxidising gaseous current, in which the deoxidising agent, carbonic oxide, must be present constantly in excess, is such, that this inflammable gas must always be discharged in considerable quantities from the mouth of the blast furnace. These waste gases of the blast furnace, which always contain hydrogen also, to a certain extent, must be capable of developing heat largely after their discharge from the blast furnace by a more perfect combustion. In those places where fuel is expensive, or where the coal used for other purposes is of a caking nature, and could be utilised as coke in the blast furnace, it has been found productive of economy to collect and employ these gases for raising steam for heating the blast, for puddling, and for re-heating iron. In the last two cases, in which an elevated temperature together with a perfect command of the operation is required, a heated blast is employed to produce complete and regular combustion of the waste gases.

To enable the waste gases of the blast furnace to be collected without injury to the working of the furnace itself, and in such a state as will permit their combustion to be effected to the most advantage, the height of the furnace must be raised, in order that these gases may be withdrawn at a point where they have finished their work, yet sufficiently far below the mouth of the furnace for them to be obtained dry, and also beneath the point where they begin to enter into combustion from contact with the atmospheric air. The full width ought to be retained in the mouth of the furnace to prevent combustion of fuel, occasioned by the excessive heat caused by reverberation, which is always destructive to the fuel when it occurs, and prejudicial to the working of the furnace whether the gases are abstracted or not. The necessary closing of the top, and the pressure required to be produced on the gases to conduct them into the channels prepared for their exit, must be effected by the materials which fill the mouth of the furnace above the apertures made for the escape of the gases.

When these conditions are fulfilled, the waste gases of the blast furnace may be rendered available as fuel for various purposes, without any injury to the working of the furnace. The plans adopted for their use in this country have been generally defective, and frequently very objectionable in their details.

The carburised crude iron obtained in the blast furnace is converted into malleable iron by one or more operations, all of which are of an oxidising character. By these it is sought to separate the carbon combined with the iron in the gaseous form as oxide of carbon, whilst the metallic bodies, forming alloys with it, and the phosphuret of iron present, are also oxidised, and pass partially or wholly into the slags.

In the Catalan fire, one of the earliest forms of the blast furnace, all the varied processes required to produce malleable iron were combined in one operation. The production of carburet of iron took place in the upper part of the hearth, (the fluidity thus acquired separating the metal from the earthy matters associated with it in the ore), and this carburet was subsequently decarburised, to a greater or less extent, in the lower part of the hearth, by the re-actions resulting from the effect of the blast, of the oxide of iron produced under its influence, and of that remaining unreduced in the slags formed. In the production of natural steel, the skill of the workman arrested this decarburising action at the necessary point.

In the modern system these operations are subdivided. The pig iron produced with charcoal, when its conversion into malleable iron is to be completed with charcoal, is decarbonised in the charcoal refinery; with or without an intervening process termed *mazéage*. Charcoal pig iron, wherever mineral fuel is accessible, is now, however, generally converted into wrought iron in the puddling furnace with coal. Pig iron produced with coke is either subjected to a preliminary decarburation in the oxidising blast hearth, termed also in this country a refinery, and the operation thus commenced is afterwards completed in the oxidising air-furnace, termed the puddling furnace; or, in recent practice, the complete decarburation of the crude iron is effected without the intervention of the refinery in the puddling furnace, by the process called boiling.

It is said that, at several works abroad, the attempt to arrest the process of decarburation in the puddling or boiling furnace at that point in which the conversion has proceeded only so far as to leave the iron in the state of steel, or subcarburet, has been successful; and that a valuable natural or puddled steel, not requiring cementation before conversion into refined or cast steel, has been the result.

All the processes employed in the conversion of crude, or carburised iron, into malleable iron, are processes of oxidation, in which the carbon is removed either by direct oxidation, or by the re-actions occasioned by the presence of oxide of iron formed or introduced during the process. The presence of oxide of iron in excess, appears necessary in all these processes to form fusible slags, consisting essentially of silicate of iron, in which the silica and other bodies, separated by oxidation from the iron, or present accidentally, are wholly or partially removed.

The question for investigation, in examining the nature of these various processes of conversion, is, therefore, whether the removal of the carbon of the crude iron, and at the same time, the elimination of the impurities contained in it, is effected with the smallest possible waste by oxidation of the iron subjected to them.

That the present systems of procedure are frequently extremely faulty, appears to be a necessary deduction from the fact, that in some of the largest iron-making districts of Great Britain, the production of one ton of wrought iron of inferior quality is only obtained by the consumption of nearly one and a-half tons of crude or pig iron.

The crude iron from which wrought iron of the best quality is produced, is that possessing a medium degree of carburation, or what is usually termed grey pig-iron. White iron, which possesses an inferior degree of fluidity to grey pig-iron, and which comes, as it is termed, more rapidly to nature, is that quality which is most generally employed in the manufacture of wrought iron, especially when the conversion is effected by the single operation of boiling in the puddling furnace; but this species of pig iron, being the result of imperfect re-actions in smelting, is always more impure than grey or more highly carburised pig iron obtained from the same materials, and does not produce wrought iron of the best quality.

In those countries in which the pig-iron produced is smelted with charcoal, but coal is available for conversion into malleable iron, the charcoal refinery is generally abandoned for the puddling furnace, it being found that the quality of the iron resulting from the latter process is sufficiently insured by its previous treatment in the blast furnace with charcoal.

In Great Britain, where the smelting process is almost exclusively conducted with coal or coke, it is found that nearly the same result can be obtained, with reference to the quality of the bar iron produced, by the treatment of the pig-iron thus smelted, in its final stage of conversion into wrought-iron, in the charcoal refinery with charcoal.

It is an important subject for investigation to ascertain what are the precise causes to which this amelioration of quality from the use of vegetable fuel is due, when used in the treatment of iron in processes which have no analogy to each other. The circumstances of the two cases appear to point to the possibility that the eliminative effect exercised as fluxes in both instances by the ashes of the vegetable fuel employed, may have some effect in producing this improvement in quality. Should such really be the case, we may then replace charcoal as fuel with advantage in those cases in which it is still employed, by the use of artificial fluxes producing an equivalent effect.

The coke refinery or running out fire occupies in this country, by its results, the same position with reference to the charcoal refinery as the process termed *mazéage* on the Continent. Previously to the introduction of the process termed boiling (in contradistinction to puddling), in the treatment of iron in the puddling furnace, the whole of the metal puddled was subjected in the first instance to the oxidising and decarburising process of the coke refinery. Refined metal is still used to a large extent, either alone or mixed with pig iron, in the puddling furnace in this country. It is also employed exclusively in the charcoal refinery.

The pig iron to be decarburised in the refinery is usually melted with rich silicates, and occasionally with oxides of iron, intended, as in other processes of this nature, to protect the melted iron in some degree from the oxidising effects of the blast, and to re-act on the carbon which it contains. The quantity employed depends on the degree to which the pig iron is carburised.

In the presence of silica in excess in the refinery hearth, the oxide of iron formed by the blast is not reduced by the carbon, but is lost by entering into the slags. It is, therefore, desirable to exclude it as much as possible in the operation. For this reason, the coke employed should be free from shale, and contain only a low per centage of ash. Lime in small quantities may be used advantageously in the refinery, to enter into combination with the silica present, but it can only be employed to a limited extent, as it would otherwise render the slags too thick.

It is of the utmost importance that the cokes used in this process should be as free as possible from sulphuret of iron, which they often contain largely. The greater part of this sulphuret present enters into combination with the metal and does not pass off in the slags.

Phosphuret of iron, if present in the pig iron, appears to be converted into phosphate, and enters into the slags. It is found largely in many refinery cinders which have been submitted to analysis.

The loss of iron in the refinery process is very large. It varies from 10 to 20 per cent.

The charcoal refinery in general use in those countries where mineral fuel is not accessible for the conversion of crude into malleable iron, is still employed in this country, when it is desired to produce iron of the best quality. It has already been observed that the causes of the amelioration in the quality of iron smelted and partially decarburised with coke, when the last stage of its conversion into wrought iron is effected by the agency of charcoal in the refinery fire, forms an important subject for investigation.

The charcoal pig iron treated in these fires is usually that termed white, or mottled, which is selected on account of the less degree of fluidity which those qualities possess, and the greater rapidity with which they come to nature. When grey pig iron is used, it is ordinarily decarburised, to a certain extent, by some of the processes termed *mazéage*. In this country, where iron smelted with coke is thus treated, grey pig-iron possessing a medium degree of carburation is generally employed, on account of its greater purity, as compared with white or mottled iron: but it is always converted into refined metal in the coke refinery prior to its use in the charcoal refinery.

Fluxes, strictly speaking, are not used in the charcoal refinery. They would not be advantageous unless the metal treated had been imperfectly refined in the coke refinery, the silicium of the pig iron and the silica accidentally present being removed by that process. The oxides of iron from the hammer and the subsilicates formed in the charcoal refinery during the latter part of the operation, are returned to the fire, where they in some degree protect the metal, as it subsides in the hearth, from the too long continuance of the decarburising effects of the blast, whilst they also exert on it, by re-action, a similar influence, accompanied by a reduction of a part of the oxide which they contain.

The melted and partially decarburised iron is raised, as it sinks in the refinery hearth, in order to expose it in every part to the action of the blast, and this operation is repeated on the collected mass, which is again brought to the surface of the fire, re-melted and sunk before the blast, until the whole is found to be sufficiently decarburised and refined throughout.

In estimating the precise nature of the effects produced in the charcoal refinery, it is necessary to observe that this fire, in common with all blast furnaces, contains, at the same time, at different elevations, a carburising and disoxidising, and an oxidising and decarburising zone. The imperfectly converted and imperfectly purified metal under treatment can, therefore, by a simple change of position in the fire, be re-subjected to the re-actions which take place in it, until the effects desired are perfectly accomplished.

The conversion of crude into malleable iron is now effected on the largest scale, both in this country and abroad, in the reverberatory furnace, termed a puddling furnace. The actual process followed is termed puddling or boiling, according to variations in the degree to which it is necessary to carry the re-actions of the furnace, according as partially decarburised or refined metal, or pig-iron is treated.

The term puddling is applied to that process in which refined metal, previously partially decarburised and separated from the impurities it contained in the coke refinery, is converted into malleable iron by subjecting it to the action of a current of heated air excited by the combustion of fuel in the reverberatory furnace in which the operation takes place. The boiling process is that in which pig-iron is converted by one operation into malleable iron by the more energetic re-actions induced in connection with this deoxidising current, by the more elevated temperature of the puddling furnace, and by the presence of a bath of rich subsilicates of iron.

The bottom and sides of puddling and other furnaces used in the conversion of iron ought to be constructed of cast-iron, kept cool either by currents of air, or, in those portions exposed to the greatest heat, by water, to prevent the re-action which would take place between the oxides of iron formed during these processes and the silica of a brick lining. The silica which might be introduced accidentally ought to be carefully excluded, as its presence must occasion unnecessary loss in the operation. These points are not always attended to with sufficient care.

The cast-iron bottom of the hearth is covered by a layer of scoria or silicates of iron. It is found that those slags which are the richest in oxide of iron and in which the oxides have been converted into the state of sesqui-oxide by calcination offer the greatest resistance. The cinders of the charcoal refinery are much esteemed for this purpose. When melted into one uniform mass, with the addition of oxide of iron, these scoria form a bottom, offering great resistance to the action of the melted metal.

It has already been observed that in the process of puddling, refined metal only is used, and that its conversion into malleable iron is effected solely by the re-actions induced by the current of air excited by combustion in the reverberatory furnace. This operation is effected at a lower temperature than boiling, and without the addition of the oxides and sub-silicates employed in the boiling process in conjunction with a more elevated temperature, to produce the more energetic re-actions required in the latter.

The process of boiling is that which is now most generally used for the conversion of pig-iron into malleable iron by the agency of mineral fuel. Its nature permits it to be employed for this purpose, without the introduction of any process of decarburation similar to the coke refinery. Grey pig-iron, smelted with coke, may be converted into malleable iron by this single process, thereby avoiding the serious waste incurred by oxidation in the coke refinery, at the same time that the use of the best qualities of pig-iron without excessive waste is rendered practicable.

Grey pig-iron, of a medium degree of carburation, being the result of a more perfect state of action in the blast furnace than that by which white or mottled iron is obtained, is always more pure than iron of those classes produced from the same minerals. The length of time and amount of work which is required in the puddling furnace before grey pig-iron is sufficiently decarburised and brought to a malleable state, is also to a certain extent advantageous, in respect to the quality of the wrought iron obtained from it, because this long exposure to oxidation has the effect of more perfectly eliminating the oxidable alloys which crude iron contains.

The process of boiling, therefore, which enables pig iron of this class to be converted into malleable iron on a large scale without the intervention of any other process, and without excessive loss, possesses great value, and it becomes important to inquire whether there are any ameliorations which may be introduced into it which would enable it to be more universally adopted than it has hitherto been.

The defects in the boiling process are the following:—the wear and tear in the puddling furnace, which occurs in treating grey pig-iron, particularly that of the more fluid descriptions; the slowness of the operation; and the amount of manual labour which it entails to produce good results.

The reverberatory furnace possesses the advantage that in the conversion of crude into malleable iron, the oxidising and decarburising re-actions necessary to effect it take place without the metal itself being at the same time in contact with the fuel, and thus subjected to the waste which would be occasioned by the earthy silicates present in the mineral fuel, generally employed, entering into combination with the oxide of iron formed. In its existing form it has, however, the disadvantage that the combustion of the fuel is necessarily very imperfect, and that neither the extent of action nor the nature of the oxidising current, is sufficiently under control.

To produce perfect combustion in furnaces of the nature of the reverberatory furnace, the air entering them ought to be divided into two parts; one of these should pass through the fuel to excite combustion to volatilise the hydrogen present, and to convert the carbon of the fuel into carbonic oxide; the other portion should be air previously heated, and this air ought to enter the furnace under pressure, causing it to traverse the furnace at a different velocity to the current of inflammable gases derived from the fuel, since it is evident that fluids of nearly equal densities, travelling in the same direction at equal velocities, will not tend to mix and enter into combination in the same intimate and rapid manner as they would if the last entering current were heated, and if they were travelling respectively at different velocities.

The current of air passing through the common reverberatory puddling furnace, is not sufficiently under the control of the workman, either with respect to its volume or its nature. This class of furnaces would be greatly improved and rendered more effective in their action in the conversion of iron by such modifications as would enable the current of air which passes through them to be rendered either oxidising or deoxidising, as required. The effect of this change in the nature of the furnace would be to restrict the oxidising action to the exact extent necessary for removing the carbon of the crude iron, and for eliminating the oxidable alloys present, while excessive waste in the metal treated would be avoided.

The more perfect combustion of the fuel employed, and the necessary control over the nature of the gaseous currents within the furnace, may be obtained by restricting the amount of air admitted through the ash-pit to that required for the generation of the inflammable gases, and by the application of blast to produce their perfect combustion, and to afford, as required, the necessary excess of atmospheric air for oxidation and decarburation of the metal. The supply of air, namely, that required for the combustion of the fuel and the blast, should be heated separately by the waste heat and waste gases of the puddling furnace.

The puddling or boiling furnace is that in which the conversion of crude into malleable iron can be effected with the greatest rapidity, on the largest scale, and at the least waste and cost. It is also the furnace in which mineral, as compared with vegetable fuel, offers the greatest advantages. Where mineral fuel cannot be obtained, it is necessary to endeavour to apply those species of fuel which exist with the utmost economy. Processes of the nature above described have therefore been adopted when the use of wood, of turf, or of the waste gases of the blast furnace have been resorted to in puddling, and with great success, under the name of gas furnaces.

In the United States, the non-flaming character of the mineral fuel in the principal coal-bearing regions of the Atlantic States, has caused the use of blast to be resorted to to produce combustion, and a sufficiently extended flame in the reverberatory puddling furnace. The whole system, as now explained, has been adopted extensively on the Continent to produce in puddling a perfect combustion of the waste gases of the blast furnace of wood, of turf, and, in some cases, of bituminous coal.

The use of fluxes in the puddling furnace offers a wide field for experiment. Hitherto, their use has been generally confined to the oxides and subsilicates of iron. The energetic re-actions of these oxides and subsilicates on the carbon of the crude iron, when brought in contact in a melted state has given rise to the term boiling, but the silicates act also as fluxes by entering into fusion with and carrying off as slags after oxidation, the greater part of the alloyed metals and other impurities contained in the crude iron. The employment in addition of fluxes composed essentially of common salt and oxide of manganese, has been successful in this country in the refining of crude iron in the puddling furnace, to a degree which has permitted the malleable iron obtained from any of the ordinary classes of minerals to be used for conversion into steel of good quality. Fluxes of this nature are employed in foreign works wherever the production of natural steel has been effected in the puddling furnace. This has been accomplished not only with pig-iron smelted with charcoal from the manganesiferous carbonates of iron in Germany and in France, but also in Belgium, at the Seraing works, from pig-iron smelted with coke from the ordinary minerals of that district.

Grey pig-iron smelted from a large class of ores with coke possesses so much fluidity, and retains the carbon with which it is combined with so much tenacity, as to create a great element of difficulty in treating it in the puddling furnace. In reducing crude iron of this class to the malleable state, by employing the intermediate process of the coke refinery, great loss from oxidation is incurred. From these causes it is commonly sought to obtain white pig-iron from the blast furnace, and this species of crude iron (notwithstanding the inferiority in quality of the wrought-iron which results from it) is that which is generally employed for its production.

To obviate this difficulty, and to avoid these disadvantages, it appears desirable to introduce between the blast furnace and the puddling furnace some intermediate process, which, like that of the mazéage practised on the Continent, shall sufficiently decarburise the grey pig-iron, (which is always produced most advantageously in the blast furnace), at a small cost in fuel and labour, and without entailing the enormous waste of the coke refinery, so as to enable it to be treated rapidly and without difficulty in the puddling furnace.

The great objection to the coke refinery is this, namely, that the decarburation of the crude iron, and the elimination of the oxidable alloys which it contains, cannot be effected in it without extensive oxidation of the iron itself, nor without separation and loss of this oxide, as silicate, in combination both with the silica formed during the operation and accidentally present, and with the silicates of the fuel.

To fulfil the proper requisites, the process adopted for decarburation ought to be such as to enable it to be effected without this excessive oxidation of the crude iron; the oxide formed ought to be reduced again; and the silica and silicates present ought to be removed as fusible earthy slags by the introduction of lime.

It appears that this decarburation might be advantageously effected by a very simple and convenient process, in which perfect control could be exercised over the extent to which the operation was carried; namely, in a blast furnace of the nature of the common re-melting cupola used for re-melting pig-iron in foundries. By re-melting grey pig-iron in a furnace of this nature, either alone or along with minerals containing nearly pure oxides of iron, the decarburation of the metal would be readily accomplished, the oxides melted with it would be reduced to the metallic state, while the silicates of the fuel, with the silica, alumina, and other easily oxidable alloys eliminated from the crude iron, would be separated in the form of fusible earthy slags.

The iron decarburised in a blast furnace of this description should be charged in its melted state into the common boiling furnace. By such a combination of the two classes of furnace, the conversion of crude iron would undoubtedly be effected with more economy of fuel, reduced loss of iron, together with greater rapidity and regularity in the operation.

It appears probable that some saving in fuel, accompanied by greater regularity in action, and less liability to produce oxidation, would be attained by similar modifications in the application of blast to the re-heating or balling furnace as those already recommended with respect to the puddling furnace.

The limits of the present paper will not permit any examination of the mechanical operations employed in the preparation of iron. This branch of the subject must, therefore, be dismissed with a few general remarks, notwithstanding its great importance, and the diversity of the questions involved.

The quality of malleable iron depends on the mechanical operations to which it is subjected in its manufacture, equally with the chemical processes by which it is elaborated. The nature of these mechanical operations determines not only the cleanness, soundness, and finish of this metal, but also those conditions of form by which its adaptability to the various requirements of the arts is affected.

The principal mechanical agents in these operations are the hammer and the rolls. It is only by a proper combination of both of these agents, that all the requisite qualities in well-manufactured iron can be obtained. In this country latterly there has been a tendency to supersede the use of the hammer by that of the rolls in effecting every class of operations in this manufacture. This is practicable in the production of small sizes of iron, in which the bulk is small, as compared with the immense mechanical power under command, but it is not practicable with iron of large sizes, in which soundness is requisite. Soundness in rails, large bars, plates, and thick sheet iron, cannot be obtained without the use of the hammer; nevertheless, its use is almost discarded for these purposes in this country.

In the Exposition at Paris during the past year, the iron-producing countries most largely represented in that branch of metallurgy were France, Belgium, Prussia, and Great Britain, and, to smaller extent, in proportion to the character of their industry, Sweden and Austria.

To render exhibitions of metallurgical products complete, they ought to comprise the minerals in their raw state, the fuel, the products in each stage of manufacture, the residual matters, and the metal in its finished state. The specimens in this state ought to display the quality of the article, to illustrate processes of manufacture, and to show its fitness for the various purposes for which it is applied. The selling price at the place of manufacture of the article exhibited ought in all cases to be affixed to it.

The expositions of the iron industry in the French, Prussian, and Belgian departments, were in many cases complete in these respects, with the exception of the element of price. The British department was extremely incomplete. Even the feature of price, in which, if not in quality, a degree of superiority might have been established, was entirely neglected.

The French department did not fully represent the iron-producing industry of that country. The principal exhibitors were Boigues, Rambourg and Co., of Fourchambault; the Company of the Loire and the Ardêche at La Voulte; the Company of the Aveyron at Decazeville; Dupont and Co., of Ars-sur-Moselle; Jackson, Petin, and Co., of Vierzon and Rive de Gier; the Company of Audincourt (for charcoal iron); the Company of Montataire; the Company of Denain and Anzin; and Schneider and Co., of Creuzot.

The chief features of the expositions presented by these companies were, the general possession of machinery of a very powerful class, the perfection of the mechanical operations as evinced by the soundness and finish of the specimens shown, and the high quality of the iron itself. Another striking feature among these expositions was the position which the manufacture of steel is taking in foreign metallurgy, not as an exceptional product, but as one of the numerous conditions in which iron can be applied to the arts.

The attention now paid abroad to the possession of machinery capable of working iron in the largest masses with facility, and the engineering skill applied to perfecting this machinery, was, among other evidence, shown in the French department by the rolling mill, fulfilling the important desideratum of rolling heavy iron in two contrary directions without reversing the machinery, with its connected travelling carriages, designed by M. Cabrol, the director of the Decazeville ironworks, working drawings of which were shown.

The quality of French boiler-plates was well shown by the remarkable specimens of forging out of the plate, of flanges and other connexions required for tubular and locomotive boilers, without the least fracture in the metal, and without necessity for rivetting in any case. The dimensions of the boiler-plates and heavy sheet iron were at least equal to those in the English department. The double-T iron exhibited was up to twelve inches in vertical section, and the angle iron to seven inches on each flange. Locomotive wheel-tyres, rolled without welding, were exhibited both in the French and Prussian departments.

The Belgian department contained numerous specimens of well-finished boiler-plate and sheet iron of large dimensions, from the works of Couillet, Grivegnée, Ougrée, Schlessin, Seraing, and many others. The most remarkable expositions in this department were, however, those of sheet-iron shown by Remacle and Co., of Lanheid, and by Delloye and Co., of Huy; and of steel resulting from the refining of puddled steel, shown by J. Cockerill and Co., of Seraing. Both of these latter expositions were well worthy the attention of British manufacturers.

The Westphalian and Rhine provinces of Prussia were well represented by Jacobi, Haniel, and Huyssen, of Ruhrort; by the Company of the Phœnix, of Eschweiler; by Boing, Rhör, and Co., of Limburg-sur-Lenne;

by the Company of Dillingen, near Sarrelouis; by the Company of Hörde; by the Royal Foundry of Lohe, near Siegen; and especially in their important steel industry by Krupp and Co., of Essen. There were numerous other exposants from Prussia in this department, some of them from Silesia. The above expositions were, however, those containing the most important objects. The boiler plates and sheet iron shown by Jacobi, Haniel, and Huyssen, were very well finished; one plate was the largest and heaviest exhibited. Its dimensions were 24 feet by 5 feet, sheared. Its weight was 2,500 lbs. The Phœnix Company, of Eschweiler, displayed the heaviest rolled bar. This bar was 10½ inches diameter by 23 feet 6 inches long. It weighed 3¼ tons. These specimens were remarkable as evidences of the character of the machinery now erecting at continental works. The expositions of these two houses presented numerous other examples of their manufacture, and complete series of the ores, fuel, fluxes, and products in the various stage of progress; the whole were also arranged in such manner as to enable them to be closely inspected. These features of completeness and good arrangement were prominent throughout the whole of the Prussian metallurgical department. In this point of view Great Britain presented a very unfavourable contrast.

The remarkable exposition of Krupp and Co., of Essen, in Westphalia, showed the wide range of purposes to which cast steel may be applied with advantage. This house exhibited rolls of large size, axles, piston-rods, cranked shafts, and other objects, up to the weight of about 5 tons in this material, proving its applicability to those purposes in which an extreme degree of strength and durability, combined with lightness, are required. Krupp and Co. are said to use the newly-invented puddled steel largely in the production of their cast steel.

The iron industry of Great Britain was neither adequately nor advantageously represented at the Paris Exposition. The display possessed in no respect the features required to place this great manufacture in a prominent point of view.

A large number of the ironworks of this country did not exhibit, and the specimens displayed by the others were not classified in any manner, either with reference to their nature, or the locality of their production. The position also in which they were exposed prevented access, for the purpose of examination, to any other than a few of the more bulky objects. The numerous smaller specimens were so placed, that it was impossible to approach them near enough to inspect them properly.

The quality of the iron exhibited was not shown in any conclusive or advantageous manner, nor were there any specimens displayed proving the application of greater or even of equal mechanical power in the working of iron in this country as compared with others.

So far as quality in the iron exhibited was concerned, there can be no doubt that great superiority was manifested at Paris by other countries as compared with Great Britain; and unfortunately there was no attempt made to place prominently in view that point in this great industry in which we are, at present, unquestionably without rivals, namely, the cost of production. By an unaccountable omission, there were no prices affixed to any of the specimens of iron exhibited in the British department.

In concluding the present subject, the following reflections appear to present themselves. Great Britain does not possess the resources of vegetable fuel, the use of which in some processes of the iron manufacture produces such valuable results in the quality of the metal so treated; and when its partial employment can be combined with that of mineral fuel, in those other processes in which the latter can be most advantageously applied, enables the best quality of this metal to be obtained coincidently with cheap production; but Great Britain possesses almost inexhaustible supplies of mineral fuel, and of iron ores, (for the most part of good quality) in immediate contiguity to each other, and these advantages are less generally possessed by other countries engaged in this industry.

Perhaps the very abundance of the mineral resources which support the iron industry of Great Britain have contributed to produce, somewhat extensively, a slovenly system of manufacture. It is at least certain, that in this country an inferior quality of iron, badly smelted, wastefully converted, and carelessly manufactured, is often produced when a superior quality might be obtained at no higher cost than that which is inferior.

It appears desirable, therefore, with reference to our future success in this department of industry, to recognise clearly, that we have no exclusive monopoly of the sources of production, and that the progress of material civilisation is facilitating the means of transport, and removing the natural difficulties interposed to this manufacture in other countries, while their industrial energies are receiving, constantly, rapid development.

It appears, therefore, highly important that we should prepare ourselves by every means for the industrial rivalry which awaits us; and the question arises, whether, in this country, we neglect any available means for this purpose? There can be no doubt that the industrial energies of foreign countries are directed, generally, by very accurate scientific knowledge, and in no department in a higher degree than in the manufacture of iron. It can only be by the diffusion of this scientific knowledge more completely than has hitherto been the case among our industrial population, and by its combination with that energy and practical knowledge which have hitherto directed them, that we can expect to maintain our present position as the chief manufacturing country in the world.

DISCUSSION.*

The Chairman said, that though they could not well enter on the discussion in full until the remaining portion of the paper was before them, yet there were so many gentlemen present capable of making valuable observations, and imparting much knowledge on the subject, whom they did not often see, that if they had any observations to make he should be happy to hear them. Though they had not the whole subject before them, yet there were many parts upon which observations might be made, without touching upon the other portions. He observed present Mr. Fairbairn, whose valuable reports on the strength of iron were well known; and he having been one of the Jurors at the Paris Exhibition, also possessed great knowledge of the iron manufactures of the Continent. If Mr. Fairbairn wished, then, to address the meeting, he should be happy to hear him.

Mr. W. Fairbairn, F.R.S., regretted that he was not present at the commencement of the paper. It certainly was of great interest, and contained a large amount of valuable information as regarded the sources of supply of iron from the various countries of Europe and America, which could only have been brought together by great research and labour. He found from the paper that the production of pig iron in this country amounted to 3,000,000 tons, whilst France produced 750,000 tons. He did not exactly catch the amount produced in Prussia, Austria, Belgium, and other countries, but he understood their amount was increasing. They knew that France alone now produced 750,000 tons, and he believed that their manufactures of iron were now becoming very important. He knew that they were making rapid strides in that branch of industry, and that their manufactures were very superior to what they were ten years since. He would not say they were as yet equal either in quantity or quality to those of England, but it behoved the English manufacturers to see that they did not get behind in the quality as well as the quantity produced. It was evident from the paper that the subjects on which it treated had been very carefully selected, and the meeting was greatly indebted to the author for the clear and instructive form in which he had investigated the geological formations of the different kinds of ores. It must appear obvious, from these researches, that we possessed in Scotland and elsewhere immense amounts of black-band, from which excellent iron was produced. He believed that the great fault of our iron was owing to the introduction of the hot blast for its manufacture. Sixty years ago, before the hot blast was introduced, not more than forty tons a week was produced. Now, since the use of coal in the manufacture of iron by the hot blast, great advantages had been conferred upon the country by the largely increased quantity of iron produced. He doubted, however, whether the quality and strength had not been greatly deteriorated, as regarded its resistance to strain and its powers of elasticity, but in other respects he thought the hot blast valuable for many purposes, and that was proved by experiments made by himself and Professor Hodgkinson some years ago. Still he was convinced that they could manufacture as good iron as ever they did, were they to return to the old process of washing the ore and coking the coal, as the material, the fuel, and the flux were the same as formerly. It appeared also by the paper, that in France there was a large quantity of the mineral in reserve, and that there were not less than 650,000 square acres of coal in that country. How much of that was workable he was not prepared to say, but it evidently must have a very marked effect upon the manufactures of that country. The author had as yet only shown them the sources from which the iron was to be obtained, but he had not come to explain the improvements and cheapening which had taken place in its production. When he came to that portion of the subject he (Mr. Fairbairn) should be glad to make a few further remarks, if he had the opportunity of attending the meeting. He would only say at present that he was satisfied other countries were making great progress in the manufacture of iron, and unless this country also made great progress, their productions would shortly be as good as those of England.

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* It will be observed that the report of the discussion on both sections of Mr. Blackwell's paper is here given.

Dr. **Percy**, F.R.S., would reserve his general observations until he had heard the remaining portion of Mr. Blackwell's valuable paper, as he thought it was anticipating the subject to enter into a discussion at present. He believed the hot blast would produce as good iron as was ever manufactured, if, as Mr. Fairbairn stated, good ore, good fuel, and good flux were employed. In Staffordshire, he used to see in a single heap 20,000 tons of tap-cinder. But as this tap-cinder contained in a concentrated form certain impurities of the ore, such as phosphorus, it was evident that in introducing that cinder into the furnace, the smelter virtually introduced impure ore. Phosphoric acid he had found existing in some varieties of tap-cinder in Staffordshire to the extent of 6 per cent. The extensive consumption of this cinder might, therefore, be one cause of deterioration in the quality of the iron now made. He believed that England possessed as good ore, as good fuel, and as good fluxes as ever, and if engineers would give the proper price for it, there would be no difficulty in producing iron of as good quality as before the introduction of the hot blast.

Mr. **Warrington Smyth**, F.R.S., was a little disappointed on entering the room to find that iron manufactures were not to be entered on that evening, but at the same time Mr. Blackwell had evidently so carefully treated his subject, that they could not object to his having a further time for the completion of his paper on that portion of it. He (Mr. Smyth) had lately had an opportunity, as a British juror, of examining the admirable collection of specimens in the French Exhibition, illustrative of the smelting and manufacture of iron. He, however, was disappointed at seeing the incomplete display of British manufacture, more especially in articles of size. Prussia, like France, had greatly improved, both in the quality and quantity of her iron manufactures, within the last few years, and he was astonished at the size of the manufactured articles from those countries and from Belgium, showing the existence there of large and powerful machinery. The English department was meagre. Though the collection, so far as it went, was admirable, it was so small that it could give no idea of the real extent of our iron manufacture. France showed water-pipes of six feet diameter, but England had none there—and he was informed that in the supply of cast-iron water-pipes for Madrid, the French manufacturers had been enabled successfully to compete with the English. Then, with regard to our wrought iron, there was very little shown, excepting some remarkably good girders. There could be no doubt that both France and Prussia were making great progress in their iron manufactures, and would become powerful rivals with England if she did not go on advancing in a still greater ratio. The Exhibition of 1851 drew the attention of Prussia to the black-band, and had led to the discovery of that ore there, and he believed that there were now forty furnaces in Prussia engaged in the production of iron from that source. A few days ago, he had seen some sword blades, not made at Birmingham, but which had been imported from Prussia, at a cost of 4½d. each. He did not say that he should like to see them placed in the hands of our soldiers in the Crimea. They were meant for Central Africa, where the best quality was not required. He was of opinion that the British manufacturers would have to contend against a very serious competition, if they did not progress in a greater ratio than at present.

Mr. **Bird** would reserve his remarks until another opportunity, when he would be prepared to join issue with Mr. Smyth on the poverty of the Iron Exhibits at the Paris Exhibition. As regards the paper just delivered, it was geologically and geographically a most excellent introduction to the subject, and he anticipated much information from the next meeting. That Mr. Fairbairn, after testing hot blast iron so completely, and finding it so nearly of a strength with cold blast, should recommend a return to cold blast, and a consequent large reduction of make, appeared singular, but the benefits arising from the cheapening of iron by hot blast, Mr. Bird was also prepared to defend if necessary. Large pipes were not an object that would have been at all interesting or necessary at the Paris Exhibition. Very large pipes up to 6ft. were made in this country, it was well-known, but English iron-masters and founders disliked to exhibit what would be considered a *tour de force*, but for usefulness and to supply a healthy demand for any required quantity, no country displayed a better assortment of all qualities than Great Britain.

Mr. **Fairbairn** wished to explain, lest he should not be present at the next meeting, that he did not mean to condemn the hot blast iron. In some cases it possessed great advantages, and from its ductility was peculiarly adapted for light machinery. But where great strain or tension was required, he could not in any case recommend it. He looked upon it as valuable, however, in consequence of its utility and adaptation for general purposes. He did not say it was the hot blast that injured the iron, but the use of raw ore and coal, introduced phosphorus, sulphur, and other substances into the iron, which injured its quality. With respect to the manufacture, he believed if they were to calcine the ore, and coke the fuel, they would have quite as good iron as formerly, and be enabled to compete successfully with all the world. He was anxious to see their iron manufactures before all others. They had got the lead, and they ought to keep it.

The **Chairman** thought they were much obliged to Mr. Fairbairn for his observations, although he believed the valuable experiments of that gentleman showed they could get as good iron made by the hot as by cold blast.

Mr. **Joseph Freeman** thanked Mr. Blackwell for his highly instructive and valuable paper. He should be sorry to allow anything to go forth which might have any tendency to frighten the iron masters, without saying a few words. If anything important was wanted by parties abroad, they came to England for it. Look at our castings of tons weight, which were manufactured for exportation. With reference to hot blast, the most conclusive argument he had heard against it was, that during the hot summer months the quality of pigs was inferior to that produced during the cold weather—a proof that cold blast iron was better than hot. He believed the paucity of the show of English iron at the French Exhibition arose from the manufacturers being so fully employed that they could not spare time to prepare specimens. He would be sorry to believe that they were behind the age in their iron manufactures. In 1851 they were told that they were behind the Americans in the manufacture of pistols, but he believed that opinion had been controverted, and that England manufactured far better small arms than any other country. They were also told that all their locks could be picked, but he understood that those who asserted it had gone back to America fully convinced that as good locks could be manufactured in this country as in any other.

Mr. R. F. Davis would not be led by the eminent examples which had preceded him, to enter upon the manufacturing portion of the subject, which was not before the meeting, but would confine himself to the geological portion, which had been brought before them in so able a manner; to pass unheeded the geological question and to then enter upon the manufacturing question, was indeed putting the cart before the horse. He could not though avoid remarking, that one great practical man (Mr. Fairbairn) was in error, when he said as good iron was not to be had now as formerly. He begged to say as good iron was to be had if people would pay the sufficient price for it. The fault of the age was, all running after Cheap John, low price, regardless of quality, but as good iron was made now as ever was produced. Reverting to the admirable paper read that evening, and for which their best thanks were due to the learned and talented author, he could not avoid congratulating the iron masters of this country, that those great visions of American overwhelming capabilities of making iron which had been brought before them last year, were, when calmly considered and brought to their fair proportions, nothing so very formidable. The excellent paper they had heard read had brought very vividly before them the great resources for iron making possessed by many countries in Europe and in America, yet it was consolatory to know that, taking into account the natural facilities which existed in this country, by the close proximity to each other of ironstone, coal, and limestone, their excellent quality for all manufacturing purposes, and the advantages of climate, to say nothing of skilled labour and ready means of conveyance, no country named by the author of the paper was likely successfully to compete with our own. He would beg though to call attention, and especially the attention of the able author of the paper before them, to other places than those named by him, which might, in time, prove formidable rivals to this country. He would allude to India, where large fields of iron ore and coal existed. Again, Borneo possessed large, and they might be valuable, fields of iron ores. Australia, too, was rich in iron ores, although, he believed, none had been found there in proximity to coal. Turkey in Europe, and Turkey in Asia too, were lands possessing the mineral more especially under their notice, in great abundance, and, he trusted, that the attention of the author of the paper before them would be drawn to all these countries—it would be most interesting and valuable to have as full information on them as we had now, thanks to the zeal and intelligence of Mr. Blackwell on other countries.

Dr. Percy had listened with delight to Mr. Bird's observations after Mr. Smyth's doleful remarks. Iron was not their only manufacture, surely; copper was nearly, if not equally as important, and yet he was informed that not one house of any repute in Swansea exhibited. He was glad to find from Mr. Bird's remarks that they need have no real anxiety as to the continuance of their own trade.

Mr. Bird wished to ask Mr. Blackwell whether he was not wrong in stating that the sparry carbonate had been smelted *alone* in this country, and whether it did not make a steel, or cold short quality of iron, and not a red short quality, as stated in the paper.

Mr. Blackwell said that the spathose carbonate had been smelted in this country alone, and he believed that, when so smelted, it had produced red short iron. In the Wear valley, the ores were of the same character as the Styrian. Although, as in Styria, the upper parts of the lodes were often changed into hydrated peroxides, they generally consisted of pure carbonates. He regretted that his paper had extended to a greater length than he had originally intended. With their permission he would withhold any remarks on the debate until its close.

On resuming the discussion on the second evening,

Mr. Bird said he was sorry that there was no one present who appeared desirous of making any remarks before he spoke on the valuable paper before them. The quarterly meeting of ironmasters at Birmingham was held that day, and that no doubt tended to keep many gentlemen from the meeting who would otherwise have been present. However gratified he had been with the geographical and geological portion of the paper, he could not help feeling that the author had been somewhat discursive with regard to the manufacturing portion, and that the difference of manufacture in different countries had been somewhat lost sight of. He also thought that the paper should have entered somewhat into the commercial part of the subject, for that had been almost entirely lost sight of, though the article of iron was one in which the manufacture annually amounted to 6,000,000 tons. He thought that the author, having for his object to show them the present condition of the iron trade of Great Britain with reference to other countries, ought to have shown them whether geologically they were worse or better situated than others, whether their mode of manufacture was worse or better, and whether they were advancing or retrograding in their commerce. As regarded the manufacturing position, the country produced 3,000,000 tons, or half the entire quantity made in the world. Exporting one-half, or 1½ millions of tons, which would require 10,000 voyages of ships of 150 to 200 tons to transport away annually, and the internal transport annually over their railways was more than 3,000,000 tons of iron alone. Indeed it was scarcely possible to estimate how great was the benefit conferred upon the railways by the traffic in connection with the iron trade and its necessary wants. Was it to be supposed that so large a quantity could find customers in all parts of the world, and that quality was not appreciated as well as cheapness. A demand embracing 3,000,000 tons must, of necessity, embrace every conceivable quality, and the great value of this industry was, that in England every quality was produced. He thought the author ought to have entered more into that subject. Indeed, it was hardly just to the producers of iron not to show that England gave the cheapest article, whilst its iron was the best suited for the general requirements of the trade.

The Chairman stated that Mr. Blackwell had gone very fully into the geographical, geological, and chemical parts of the question; and had he entered fully on the manufacturing and commercial parts, he must have occupied two evenings more.

Mr. Bird was referring to the title of the paper, which surely embraced those points. With regard to the manufacture of iron, he might observe that the paper did not say one word about the brown clay and lignite of Austria.

Mr. Blackwell—That was in the last paper.

Mr. Bird—Not a word as to the mode in which they were used. There was also the peat and gas-manufactured iron, of considerable interest.

Mr. Blackwell had done his best considering the limits of his paper.

Mr. Bird would say a few words, then, with regard to foreign countries, who, they were told, were following close upon our heels in the iron manufacture. Why Prussia, in 1854, manufactured less than 250,000 tons. He believed it did not exceed 215,000 tons, and surely it could not be said such a country was treading closely on the heels of one where 3,000,000 tons were annually produced. Now, with regard to the progress made by this country, in reference to that of others, we found that in 1845 France manufactured 510,000, whilst she now produced 750,000 tons annually, showing an advance of not quite 250,000 tons in two years, whilst in nine years the manufacture in this country had increased from 1,500,000 to 3,000,000 tons. He thought, therefore, the English manufacturers had no reason to be afraid of the competition, and that the energy and industry of our own country had not received perfect justice at the hands of Mr. Blackwell. He did not wish to say much about the Paris Exhibition. It should not be condemned, as it had been by the author, for it must have some redeeming points. He would say a few words on the subject, because this paper would go forth to the world with the authority of Mr. Blackwell's name. He stated, "to render exhibitions of metallurgical products complete, they ought to comprise the minerals in their raw state, the fuel, the products in each stage of manufacture, the residual matters, and the metal in its finished state." It never was intended that the Paris Exhibition should embrace these matters. It was an exhibition of the Iron Trade, and ought not to combine the fuel, the ore, and the fluxes. No one who came to him to purchase iron rails or other descriptions, ever said, "Let me see your ores and your fluxes." They must also recollect that in the limited space allotted to them it would have been impossible to have such an exhibition, especially when showing the productions of 70 exhibitors. The make of pig iron in Scotland exceeded 820,000 tons per annum—an amount greater than the whole manufacture of France, or of the combined manufactures of Austria, Prussia and Sweden; yet one square yard of space would have been sufficient to illustrate that manufacture of 820,000 tons; all that was actually required being four pigs, marked, respectively, Nos. 1, 2, 3 and 4, thus showing the whole of the qualities manufactured. Though there were, possibly, three tons, from different makers, in the Exhibition, still the four specimens he had mentioned would have been sufficient to show to Frenchmen and other foreigners the qualities of Scottish iron. There was no part of the exhibition of English iron which did not appear to him to have been, as far as possible, properly arranged as to locality. There was the pig and bar iron of Scotland, the bars and pigs from Yorkshire and Wales, and the iron of Staffordshire and Derbyshire, all systematically classified. Then, it was said, there was no price affixed to the iron. It was true each article was not priced, but on each stand the prices were given in conspicuous figures, as showing the approximate value of the iron of that description; the Scotch hot blast iron being marked at from 75s. to 80s. per ton, and superior qualities £6 to £7. It was the same with the bar and the sheet iron; and, moreover, reference was made to an office close by where any information could be readily obtained. He had told them what might have been done for Scotland in a yard square; the same might be said of the products of the Ebbw Vale Company, and Messrs. Guest and Co., who confined themselves almost to one department of manufacture for sale. The manufacturers of France made and showed pig iron, malleable iron, chain cables, tin plates, wire, &c., so that each manufacturer could make a taking display in the exhibition. He was not there to eulogise or apologise for the difference of the English system, but only to show what it was. The Ebbw Vale Company exhibited some sections of rails of excellent quality, as did also Guest and Co. Yet, notwithstanding the Ebbw Vale Company were manufacturing 2,000 tons per week, the nature of their products did not require many yards square to exhibit. The Dowlais Company, Ebbw Vale Company, and Messrs. Bairds, he believed, were manufacturing fully 250,000 tons a year together, and yet, though these makers manufactured nearly as much as Prussia, all they made could have been well represented in a few yards square. Though the articles shown by the English exhibitors were consequently confined to a limited space, yet there were several objects which, to practical men, were of the greatest interest. In the first instance, the English department showed, without exception, the finest specimen of rolled iron. Mr. Blackwell alluded to the rolled bar of the Eschweiler Company, of 10¼ inches diameter. That bar was shown in conjunction with the section of the pile from which it was manufactured, a pile packed round the size of the bar. Any one knew that a pile so packed would produce a bar by once passing through the roll, but a bar of any diameter, so produced, was not equal to Messrs. Bagnall's bar of 7¼ inches produced from a pile which was packed square, and had probably gone through the roll thirty times. The next object of interest to which he would allude, were the taper bars and ship's knees exhibited by the Mersey Company, of Liverpool. Their process was to roll a piece of iron, which might be four inches in thickness at one end, with the assistance of hydraulic power, so that it should gradually taper off, and, probably, not exceed one inch in thickness at the other. Then there was the English "Barlow" rail, as exhibited by the Rhymney Company, it being well-known that the French had never been able to succeed in making Barlow's patent rails, even to their own satisfaction. England had also in the Exhibition the heaviest and largest rails. There was, moreover, a wrought iron 9-pounder cannon, which had never been looked at by the jury or tried. He believed it was the only one in the Exhibition. It was beautifully finished, and had been turned out of hand by Messrs. John and Edward Walker, of Gospel Oak. The English had in the Exhibition every description of bar-iron, from the lowest at £7 10s. per ton, to bars at £14 per ton. He felt that there were many shortcomings on the part of his countrymen in the Exhibition, but he could not conceive that the iron trade of Paris could, from their display, come to the conclusion that England was "the poorest country in the world" in the iron trade. He had not spoken either of the plates of the Shelton Company, of Staffordshire, or the Derwent Company, which were of excellent quality and texture—or many other matters, but he had occupied the time of the meeting already too long, and begged to thank them for the attention given to him.

Mr. Anderson (Inspector of Machinery, Royal Arsenal, Woolwich) said, that while he felt greatly interested in the very valuable paper which had been read on the important subject of iron, he took a very different view of the question from Mr. Bird, who, along with the great majority of those engaged in the iron trade of this country, seemed to make quantity rather than quality the great consideration. He believed that, as a nation, we thought a great deal more of the gold than of the quality of the material which we produced, and that, instead of improving in quality as we ought to do, we were in reality descending, and were actually making worse iron as a whole than we were 50 years ago. In the position which he (Mr. Anderson) occupied, where the quality of iron was the chief object, and from having ample opportunity of knowing how little was done to improve the quality of our material, not only by the ironmasters who make it, but also by the engineers who use it, he felt at no loss for the cause of this most lamentable condition, that while there were a few who had made and do make systematic experiments, the great majority do not, hence the quality was degenerating year by year, until at length it had become celebrated for its cheapness and inferiority all over the world. In 1854 he went to the United States of America, and, on arriving in Boston, visited the foundry of Mr. Alger, and was much struck with the rigid system of testing to which the iron was subjected, not occasionally for the sake of experiments, to be published merely, but daily, for Mr. Alger's own information, for the express purpose of improving the strength and elasticity of his castings; and these experiments were conducted in a careful manner, with every particular recorded. As a natural consequence, they had raised the quality in an extraordinary degree, its strength being equal to 40,000 lbs. per square inch, which was nearly four times the strength of some Scotch iron. In other large foundries which he visited a similar system was prevalent, and the same kind of testing apparatus was employed, more particularly at the celebrated works at West Point, in the State of New York, and at the establishment of Major Wade, at Pittsburg. In their foundries, Scotch iron was largely employed chiefly for its cheapness, but when strength was an object they employed other iron, mostly Pennsylvanian, or from Nova Scotia. Having occasion to visit the Continent a few months ago, he found them all eager after a superior quality, while the question of cheapness was secondary. In the foundry at Liege a constant series of experiments are carried on, in regard to the tenacity, compressibility, elasticity, transverse strength, (by driving a steel plug into a conical socket,) and other similar experiments, which are all entered in a properly tabulated book, along with a complete statement of the mixtures, the fuel, the flux, state of the blast, atmosphere, and other conditions. The result of such a course could not fail to improve the iron, and all concerned, in regard to its manufacture. In the new foundry at Spandau, they even went farther than this, for, in addition to these mechanical tests, they had a complete laboratory alongside the workshops, where careful analyses of the metal were constantly being made. They had also an immense hydrostatic balance, for taking the specific gravity of the castings. By these several means they were enabled to know precisely the condition of the metal which they employed. How unfavourably this system contrasted with the general practice in our country, where the great aim seemed to be to make money. Such a state of matters was deeply to be deplored by all who had the prosperity of this country at heart, and unless our engineers, as a body, commenced a similar system of testing the iron which they purchased, and insisted upon a certain amount of strength and elasticity, he feared that the present tendency to inferiority and cheapness would ultimately injure the iron trade of the kingdom.

Mr. **KENNARD**, though agreeing in the principles laid down by Mr. Anderson, was bound to say that commercially he could not follow them. Men in trade must look at the means by which they would best protect their own interests and develope their business. He quite agreed with Mr. Anderson that it was desirable to improve the quality of their iron, but he thought Mr. Bird's remarks had shown that those states were commercially the most prosperous where the quantity and quality of iron produced were found in the long run the most useful. The whole system of English manufacture was rather to develope the quantity than the quality, though both were important. He observed that purchasers never thought so much of quality as of cheapness, and those houses which had done best, were those who could supply the largest amount of iron which would stand the test required for ordinary purposes. It was true that in the Exhibition of 1851, in the cutlery department, there were shown surgical instruments, &c., which, for finish and workmanship surpassed our own—indeed, with which England could not compete. No doubt in this respect there could be no comparison between the manufactures of England and those of France and Prussia; but, as a nation, England had the greatest amount of useful productions. As long as the present system prevailed there would be a desire to manufacture for cheapness rather than quality. In looking back at the history of the iron masters of the country he found that those were placed in the happiest position who had gone for the quantity produced; and, with the profoundest respect for the opinions of Mr. Anderson, he thought that the iron masters, under the pressure placed upon them by the consumers, were justified in going for quantity rather than quality, though he would be glad if he could see both combined.

Mr. R. F. **DAVIS** thought the especial thanks of the Society were due to Mr. Blackwell for his valuable paper, but it was also deeply indebted to Mr. Bird for his observations. The author of the paper had gone well into the geographical and geological part of the subject, and he had got the manufacturing part up to boiling point, but no further. He thought it was a pity the boiling point had not been treated more briefly, or that the subject had been delayed to a later period in the session, when they could have heard something more of the manufacturing and commercial part of the question. He was sorry the paper had not more closely pointed out the difference between the articles exhibited by Great Britain and by other countries, as it was not at all difficult to produce the *tours de force* shown by their neighbours in the Exposition. Mr. Anderson differed much from the rest of his countrymen, in being more fond of glory than of siller, and he did not think many of the Scotch ironmasters would agree with him. Mr. Anderson had spoken of the attention paid by the Americans to quality, but there was not a man in the trade who did not know that the American customer never said a word about quality, but always about cheapness. It was not goodness but cheapness they looked to, and therefore they bought large quantities of Scotch pig-iron, though they would prefer buying the bar at the price of pig. If he were asked the question, he should be compelled to say, there never was an ironmaster who went for honour and glory, but always for profit. If the Yankees did not go for dollars in America, as they came across the salt water they certainly lost or changed their character. He (Mr. Davis) could have wished that in the geographical portion of the paper, more had been said relative to Turkey in Europe, Turkey in Asia, Australia and India. In the latter countries were most important mineral fields, which might be brought into competition with England, but they need not fear anything that could be done in Europe, notwithstanding all they had heard about France and Prussia. The agricultural interest, it used to be stated a few years since, only flourished because it was protected, but now protection was gone it was stronger than ever. The iron trade of France existed because it was protected, but if they would take off the duty, the English would in their own markets, in the words of Jonathan, eat them off the face of the earth, and bring about for themselves a more healthy trade. He thought Turkey in Europe and in Asia worthy of attention, because, with returning peace, there would be a rush of English capital into those countries, where it would find a good field for its exercise. There was also India and Australia, that second England across the waters, worthy of great attention. There were on the table some specimens of iron and iron ore from Australia, which, though they might yet be regarded as only *tours de force*, were worthy of attention, as evidences of what might be expected from a country where they had whole hills of ore. He (Mr. Davis) trusted upon some future occasion Mr. Blackwell would tell them something more about the manufacture of iron, and also turn his attention to the commercial part of the question.

Mr. **BLACKWELL** said the hour was so late that he should only reply very briefly to the remarks made by some of the preceding speakers. Mr. Bird had said that the paper now concluded was incomplete. He had not ventured on any criticism of the practical part of the paper, but had asserted that no notice was taken of the use of lignite and turf abroad, nor of the possible use of the latter in the iron manufacture in Ireland. He was wrong in this statement. These subjects had been spoken of in their proper place, and if Mr. Bird had listened to that part of the paper read to-night, he would have found that the means adopted abroad for utilising these species of fuel in the puddling and re-heating furnace had been fully explained. Mr. Bird had evidently been guided in his remarks by his own narrow view of the nature of this paper. He had looked at the subject in a commercial point of view only, as an iron-merchant, and not as an iron-master. The subjects discussed in the paper did not interest Mr. Bird; perhaps he (Mr. Blackwell) might be permitted to express the opinion that Mr. Bird was not qualified to judge of this paper, but that the subjects discussed would be regarded with some interest by the iron-masters of this country. The main features of the paper were—first, a general view of the resources of this and other countries for the production of iron; secondly, an examination of the principles involved in the various processes of its manufacture; and, lastly, a short account of the state of this industry in other countries as shown by the Paris Exposition. Far from under-valuing the element of cheapness in production, he (Mr. Blackwell) thought that an examination of this paper would show that the main question throughout was, whether the existing processes of the iron manufacture were of such a nature as to permit their amelioration in any respect, so as to enable iron to be produced with more economy of material, and, therefore, at a lower price than it now is. Mr. Bird's remarks were, some of them, of a rather ambiguous nature. The space for the British Iron Exposition was too restricted to permit it to be made complete; but one foot square was all that was required for a full exhibition of the products of the Scotch iron trade. It was most profitable to make cheap inferior iron, without reference to the possibility of the improvement of the present processes, without entailing extra cost; and the fact of the products of the Lowmoor Iron Company finding their way into France, was cited to prove that the English system of making cheap inferior iron was the best, commercially. The continental houses who exhibited any specimen of large size, showed nothing but a *tour de force*, but the fact was not mentioned that access to the British Exposition was obstructed by masses of rails 80 feet long, which prevented any examination of the quality of the smaller specimens of iron. In conclusion, he (Mr. Blackwell) hoped that Mr. Bird would complete his review of the iron industry by a paper on its present commercial position and movements, which no man was more competent to touch with ability and correctness.

Mr. BIRD might mention, with regard to charcoal iron, that in Austria it was found that castings were much improved by the admixture of Scotch pig iron with the charcoal pig. It was well known also that a good strong iron might be obtained by the admixture of four or five qualities, each of which might in itself be tender. He might also be allowed to tell Mr. Anderson that the beautiful iron castings of Berlin, consisting of trinkets, bracelets, &c., were principally made from Scotch pig iron, without chemically testing it.

On the motion of the CHAIRMAN, a vote of thanks was given to Mr. Blackwell for his valuable paper.

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 16th instant, was "On Tonnage Registration," by Mr. C. Atherton, M. Inst. C.E. On this evening Capt. J. M. Laws, R.N., will preside.

The SECRETARY has received the following letter on the subject of Mr. Blackwell's paper, and the discussion upon it:—

SIR,—The very able paper of Mr. Blackwell on our iron industry called forth remarks in the discussion rather of passion than of the philosophy which distinguished Mr. Blackwell's paper. The object of Mr. Blackwell was to show that it might be a very practicable thing to produce good iron at the same cost as inferior, and that the knowledge requisite to attain this object was very well worth seeking after; and hints thrown out to this effect were readily and usefully echoed by Colonel Wilmot. But the gentlemen who can see nothing in any kind of work save its reducibility to immediate pecuniary profit, and who probably would be ready to work up all the raw material of England in one week, to throw it into the sea the next, for the sake of a per centage on the transaction—on the one hand; and the gentlemen on the other, who set up perfection in manufacture as the only fitting object for worship, have simply given us another version of the contest of the black and white shield.

In truth, good and bad are relative qualities—meaning, superior and inferior; but, *quoad* what? We need ductile iron for wire, and rigid iron for pillars and girders; and it would be better in all cases to supply their places with steel, if it could be had with the same amount of human labour. A very perfect rail could be made of the material of a watch main-spring, but it would be a very aristocratic luxury to have the mass of railways unmade, in order to apply the capital in a special line of superior rails to Windsor or Brighton. I cannot agree with those who scoff at our iron industry, because fortunes are made by supplying a cheap material for common purposes, and I think the fortune-maker a very useful member of the community, for helping to turn stone roads into iron ones, even though of inferior iron. It may not be the highest kind of taste to think an agency in the accumulation of money capital is the most worthy of all objects, but the men who pursue this fulfil a part in creation at the command of Providence, as surely as a Liebig, or a Faraday, a Bacon, a Newton, or a Shakspeare; and the Americans are not more imbued than ourselves with the spirit of reverence for artistic perfection in work. England truly supplies a want which the world feels and expresses for cheap iron, and while the demand shall continue for low-priced iron—the only iron the masses can afford to pay for yet—she will continue to supply the want. As the masses grow richer they will need better iron, and the stimulus given England will produce that better iron in larger amounts, cheapening it as she best may under the pressure of competition. The coal, the ironstone, the climate, and the people, are gathered together in a favourable locality for work on the large scale; and in that work which it is the instinct of the Anglo-Saxon to perform. diligently, which he has never yet shirked, and probably never will; they will continue to excel in the iron trade till the coal and iron shall be exhausted. That they prefer a hundred church-clocks to one chronometer, or a fleet of iron ships to a pleasure-barge, should not be an imputation on them. They do that which other nations do not; and if the common iron they now make by millions of tons, points the way to a demand for an equal amount of better iron, that also they will be ready for.

Notwithstanding, we must not lose sight of a truth embodied in the outcry of those who advocate the sacrifice of profit to excellence of production. The mere money-hunters may go on competing with each other to the point where utility is sacrificed and profits disappear in the contest to produce rubbish. Nothing is more certain than that the originator of new things is the best friend to the manufacturer. He gives him a fresh vantage ground whereon to regenerate a losing trade. It is the constant tendency of manufactures to cheapen. In proportion as a process becomes common and certain, profits lessen; and it is a frequent remark, that if business were as easy to do and as certain as the funds, it would only produce the same annual interest. A sprinkling of enthusiasts amongst our guilds of workmen as well as masters is a gain to the community. Some years back, an English traveller wished to possess himself of a pair of miniature boots exhibited in the window of a *cordonnier* in one of the Parisian *passages*. No inducement could make the man dispose of them. "You can make another pair," said the traveller. "Never!" shouted the master, striking his breast as only a Frenchman can; "they were made in a moment of enthusiasm." Laugh as we may, it was this spirit that captured the Malakoff, and it is this spirit, gradually growing more rife in England, which will prevent manufacturers from falling into the pit of unprofitable money-grubbing. Artists and inventors will scheme to

"Ring out the old ring in the new!"

as their appointed time comes round, and the manufacturer,—the industrial chief who rules files of workmen,—will become more and more aware that the mind of the philosopher is an element that he can no more dispense with than he can with his capital.

I do not believe that the labour of Mr. Blackwell will be thrown away. His words will produce fruit in the silent mode in which such things take place in England. Even now many teeming brains are stirring with thoughts of the future, and when the custom-houses of Dover and Calais shall be let for warehouses, and the huge ship of Scott Russell shall be a channel ferry, moving incessantly across the "narrow sea" to its alternate landing-stages, between stone moles on either coast, then will the marvels of international rivalry spring up in all their glory, in which the mutual superiority of both nations in divers things will continually strengthen their mutual interest.

I am, sir, yours faithfully,
W. BRIDGES ADAMS.

1, Adam-street, Adelphi, Jan. 9, 1856.

RATING OF INSTITUTIONS.

The Working Men's Educational Union recently appealed against a poor-rate made upon the premises occupied by that Society. The case came on for argument in the Court of Queen's Bench, and on the 23rd November last Lord Campbell delivered the following judgment. The particulars of the case sufficiently appear in the judgment, as taken from the short-hand writer's notes, of which a copy is subjoined:—

Lord Campbell said,—The question to be decided in this case is, whether the Working Men's Educational Union, as described in the Second Annual Report of that Society, is a society "instituted for the purposes of science, literature, or the fine arts, exclusively," within the meaning of the statute, the 6th and 7th Victoria, chapter 36, so that a house in the parish of St. Martin-in-the-Fields, occupied by the Society for the transaction of its business, is exempted from rateability for the relief of the poor? This is a most laudable society, the members disinterestedly devoting themselves to the improvement of their fellow-creatures; and if the principle were to be acted upon by the legislature that laudable societies should be encouraged, by increasing the burdens of the ratepayers of the parish in which the house of business appears to be situated, although the object of this Society be not of a parochial nature, this Society will have a right to the exemption now claimed. But hitherto exemption has been confined to societies instituted for purposes of science, literature, or the fine arts, exclusively; and looking to this Society as described in its Second Annual Report, we do not think that it comes within the statutable definition. It uses science, literature, and the fine arts as part of the means for gaining its objects, but its direct objects are not the cultivation or promotion of science, literature, or the fine arts; and some of the purposes for which it was established and instituted cannot be connected with science, literature, or the fine arts. The report states, "that the Working Men's Educational Union was founded in the year 1852, having for its objects the support of the efforts variously put forth for the elevation of the adult operative population, as it regarded their physical, intellectual, moral, and religious condition." The words of the first fundamental law are:—"That this Society be designated the Working Men's Educational Union," having for its objects the elevation of the working-classes, as regards their physical, intellectual, moral, and religious condition. The means are, by encouraging popular literary and scientific lectures—by preparing suitable diagrams and other aids to lecturers—and by promoting the formation of popular lending libraries and mutual instruction classes. There is a provision that the publications issued or recognised by the Society shall be free from party politics of the day, and shall be scriptural and unsectarian in their character, but there is no other qualification upon the express objects and purposes of the Society. Now it is clear that any lecture would come within the scope of this Institution which may fairly be considered as leading to the elevation of the working-classes as regards their physical condition; such as lectures teaching them how their lodgings, clothing, and food may be improved, whereby their physical condition may be elevated. It follows that the funds of the Society may be properly applied to the preparation of diagrams explaining how cottages may be better built, ventilated, and cleaned; how the garments of the labourer may be better made and mended; and how his food may be more economically cooked, or rendered more nutritious. Reviewing the very multifarious subjects discussed by the lecturers, as stated in the report, the physical condition of the working-classes does not appear to have been so much attended to as might have been expected, although we have one lecture on "Total Abstinence from Alcohol;" but to promote their intellectual improvement we find many discussions, all perfectly salutary and elevating, but several of them showing that they have no connexion with science, literature, or the fine arts,—for example, "Ought we to ask for the Ballot?" "The Voluntary Principle or an Establishment, which?" Although diagrams of a balloting-box, of a cathedral, or of a dissenting meeting-house may be called in aid by way of illustration, surely it was not meant by the legislature to exempt from rateability to the maintenance of the poor the houses in which instruction upon such subjects is communicated by the lecturers, or in which they are discussed after the manner of a debating club. We should have placed no reliance upon such a discussion in a provincial affiliated society, unrecognised by the parent Society in London, but the second report of the parent Society recognises and approves of the discussion of such subjects by the affiliated society, which are to be encouraged by suitable diagrams and other aids to the lecturers. "This course," says the report, "is justified upon the grounds that political subjects will be discussed elsewhere, generally in the pot-house, and that it must be desirable that such discussions should take place where moderation can be enjoined, and partizanship abated, and the information afforded likely to direct to right conclusions, while, at the same time, freedom of debate is secured, and opinion allowed unfettered expression." In considering these cases, the Courts have had to ascertain the purposes for which the Society is instituted, and would not only look to its written laws, but to the purposes to which the funds of the Society have been practically applied. We do not yield to the objection made at the bar, that Mr. Scott had a beneficial occupation of the house, as we believe that it was used for the purposes and objects of the Society, and for no other purpose whatever; nor to the objection that the subscribers had a benefit, from being allowed to buy diagrams at a reduced price, as *profit* was *not* the legitimate object of the subscription, and they could not buy diagrams to sell again without being guilty of abuse. Nor was the objection much relied upon by Mr. Pashley, that some religious and biblical subjects are lectured on, such as "The Bible, its Origin, &c.," "The Spread of the Gospel of Christ," "The History of the Greek Church," "St. Peter's Chair, or the Popes of Rome," for there is a sacred literature as well as a profane, and all these subjects may be treated as part of sacred literature, without engaging in controversial theology. But as both by the laws and usages of the Society, some of the purposes for which it was instituted appear clearly to us to be different from those of science, literature, and the fine arts, we must, upon this ground, decide in favour of the respondents. Had the founders of this Society had in view the purposes mentioned in the statute, and no other direct purpose, we should not have thought that they were disentitled because the purposes being served they had in view consequentially the object of elevating the condition of the working classes. In the Queen *v.* Jones (8th Queen's Bench), Lords Denman and Patteson, Williams and Wightman, Justices, all express a strong opinion that a society instituted for the diffusion of religious principles and sentiments, though by literary means, is not within the exemption. So in the Queen *v.* Pocock (8th Queen's Bench), it was expressly held that a society instituted for the purposes of education was not entitled to the exemption, although the object was to be gained by scientific and literary means. Williams, Justice, there said, "We find that algebra, trigonometry, elocution and poetry, are to be taught; these certainly come within the terms *science* and *literature*, but that does not show that the society was instituted exclusively for those purposes." In the present case there is a part of the object and a part of the means to be employed wholly unconnected with science, literature, and the fine arts. In the case of the Linnæan Society, supposed at the bar to be in favour of the appellant, that Society was admitted to be instituted exclusively for *scientific purposes*, and the main objection urged to the exemption was, that the subscriptions were not voluntary. According to the Queen *v.* Cockburn, and various other authorities, this society, however meritorious its objects, is not entitled to the claim it has set up, and we can feel no regret in being obliged to arrive at this conclusion, for, if the exemption were allowed, the ratepayers in the particular locality would be taxed for the support of an Institution from which they derived no local benefits. Where a fund, such as the poor's rate, is to be raised by taxing the inhabitants of a defined district, Parliament, with all its omnipotence, cannot relieve some of those inhabitants from payment without increasing the burden of the others. We, therefore, give judgment for the respondents, with costs.

Home Correspondence.

ALLIGATOR AMBERGRIS.

SIR,—In Mr. R. Temple's admirable letter, dated from Belize, British Honduras, and which appeared in the *Journal of the Society of Arts* on Jan. 4th, he speaks of an odorous substance which the alligator throws off, resembling, as he says, musk. I am inclined to believe that the material is more likely to be found to resemble ambergris; however, if he will send some of it to England, I shall be very happy to test its value as an odorous body, in a perfumery sense, and if it really be of the value he anticipates I can at once offer him a market for it. The present price of grain musk is about, say, 70s. per ounce, and that of ambergris 16s. per ounce, the latter being scarce in England at present. I quote the above prices in order that Mr. Temple may form an idea of the value of a substitute for musk or ambergris.

Yours faithfully,
SEPTIMUS PIESSE,
Of the firm, Piesse and Lubin, Perfumery Factors,
2, New Bond Street.

January 7th, 1856.

THE RESINS OF COMMERCE.

SIR,—I was at the meeting of your Society on Wednesday last, when Mr. P. L. Simmonds read his paper on the "Gums and Resins of Commerce," and I have, since its publication, gone through it with considerable care.

The public will, I am sure, be much obliged to Mr. Simmonds for bringing this subject under its notice, for it is one on which (I speak more particularly of the resins) very little is known, and on which a large number of individuals are very deeply interested; and in submitting it to the consideration of the members of your Society, I trust Mr. Simmonds has taken a course calculated to elicit some valuable information respecting the matters of which his paper treats.

Having little acquaintance with the Gums of Commerce, I will pass over that part of Mr. Simmonds's paper, and come at once to the Resins, on which I have a few remarks to make; and I trust Mr. Simmonds will excuse me doing so, as they will be made more with a desire to elicit information, than for the purpose of criticising the paper now under consideration. Mr. Simmonds says, that the resins "are either natural exudations or are obtained from some vegetable compounds by the aid of alcohol." I am acquainted with many of the resins of commerce of the first sort, but not of the second; there may be such resins, but I think, commercially, they are unknown; and further, "they (the resins) have no smell except when they retain a portion of volatile oil;" from this it would be inferred that those resins which have no smell contain no volatile oil; but this, I apprehend, is not the case, for many of the resins of commerce, copal and anime, for instance, and others used by the varnish-maker, have no smell when cold, and yet they contain large quantities of volatile oil, which the application of a very little heat disengages from them.

I observe it stated that resins are used for varnishes and other purposes, and also for ornamental *house-papering*. I do not know exactly the use indicated here, but, probably, it is meant that resins are the component part of the varnishes used for varnishing paper-hangings.

In looking through the paper, I find, under the head Copal, and in other parts, that this resin copal is the product of large trees in the East Indies, is found in Palestine, Abyssinia, Africa, New Zealand, Brazils, the Phillipines, Singaporo, Madagascar, South Africa, the interior of South America. It appears, therefore, that copal comes from three-quarters of the world, as well as New Zealand. Now, I do not mean to say that the term copal, as applied to the resins of those different countries, is an improper one, because I believe, as Mr. Simmonds states, that in South America the word Copalli is the generic term for all resins, but I take leave to doubt whether the copal of commerce of this country would not be found to be a very different article to the resins produced in any part of the East Indies or New Zealand. I think it will be found that the East Indian copals here mentioned are not copals, but dammar of some sort, which, although, imported and entered as copals, are sold on their arrival by the merchants here as dammar.

The copal of commerce, a resin used principally, I believe, by the varnish-makers, is a product of Africa. It comes to England direct, the sort most prized and the oldest known being the Sierra Leone copal. Other varieties of resins have lately come into the market. They are called copals, and are the product of the Western Coast of Africa, and come direct, in most cases, from there to us. Accra, Angola, Benguela copal, are the names under which they appear in the London price current.

It is not probable that the products of this, the Western Coast of Africa, would find their way to the East Indies, but the case is different as regards the other side. The resinous products of the Eastern Coast of Africa, amongst which would be found the best sorts of anime, and a resin commercially called East India copal, are most probably collected by the Indian merchants, carried by them into Indian ports, and from thence shipped to this country. The resins so obtained are, however, African productions, and not Indian; they are generally good in quality, and fit for the oil varnish-maker. It is a fact that the resins best adapted for this class of manufactures are almost all tropical productions.

I am not aware of the commercial distinction, which Mr. Simmonds makes, of the copals into hard and soft.

The "copal proper," which Mr. Simmonds says all comes from India, whatever its primary source may be, and the "East Indian copal from Calcutta, the most common commercial variety, and in which pieces of all other sorts of copal are to be found," are, no doubt, different sorts of dammar. The copal from New Zealand is the resin known here under the name of Cowrie, Cowdie, or *Kauri*.

In referring to my collections of specimens of resins containing insects, Mr. Simmonds says, they occur in amber, the Courbaril resin of South America, copal, *anime*, and in copal from Accra. I wish to observe here that I have never seen an insect in the Sierra Leone copal of Africa, although I have had tons of it through my hands; this is singular, and worthy of inquiry. In anime they appear most abundant.

I have to apologise for troubling you with these remarks, but I am anxious for information, and trust that Mr. Simmonds's paper will lead to inquiry, and that we may receive from some of your readers accounts of the resins of Africa. It would be very desirable to know their origin, age, and mode of collection. I am told that the tropical Resins of Africa are true fossils, but I have been unable to learn whether this is the fact or not.

I am, your obedient servant,

THOMAS H. WALLIS.

64, Long Acre, Dec. 4, 1855.

THE ASSAM SILK WORM IN THE WEST INDIES.

Sir,—By the first November mail last year, through the kind attention of his Excellency Sir William Reid, Governor of Malta, I received a supply of the Assam silkworm, which feeds on the castor oil plant, *ricinus communis*. Thirty cocoons had been placed in a bamboo bird-cage, at Malta, and during their voyage hither *via* Southampton, the moths came forth, and deposited about 1,200 eggs, which on their arrival had begun to hatch. These I soon distributed by twenties and fifties to all who chose to try the experiment, which perfectly succeeded as far as relates to their being adapted to this climate, and to their propagation rapidly and perfecting the cocoons. This is abundantly proved from the fact that this day (being twelvemonths from their introduction) I have the eighth generation of worms now hatching, having had seven crops of cocoons within the year.

These worms multiply one hundred-fold in each generation, and there is no doubt of their being easily fed to any amount, provided that their product can be sold in the European market in the state in which it is when the moth comes out from the cocoons, of which I enclose you a sample.

As the castor oil tree grows very rapidly, and can be cultivated without much expense, and yields a good return in its very abundant seeds, it is admitted by most persons that the employment of persons in raising silk could be advantageously adopted if the product can be turned to good amount. The object of my letter is to solicit information on this head, say,—

1st, Whether cocoons, such as those enclosed, can be sold in England, and at what price.

2ndly. Whether they can be rendered saleable by any treatment, and if so, by what description of treatment can they be made marketable.

3rdly. What description of machinery is used for rendering Assam silk fit for manufacturing purposes, and what is the cost of such machinery or such portion as would be required to prepare the cocoons previously to shipment.

4thly. What is the value of the castor oil *beans* in London, Liverpool, or elsewhere.

I shall feel obliged by information on these and any other points tending to elucidate the problem of the profitable raising of silk in these islands.

I would not have your readers to infer that the castor oil silk-worm can be raised in the open air; on the contrary, they must be kept in the shade, and carefully protected from various enemies that abound in these climates, as ants (which are a pest), lizards (innumerable), and jack spaniards, or wasps, (which appear to take a malignant pleasure in destroying the delicate creatures by stinging them to death); from their whiteness they also attract many birds, and domestic fowls feed on them with avidity. It may be, that from their rapid powers of multiplication, they may yet be established in the open air upon a large scale, when we shall have planted large fields of the castor oil; at present all our open-air experiments have been made with small quantities on single trees, and therefore this point cannot be cleared up until after we know whether the silk cocoon be of any value.

I shall be glad also to learn (further than I see in Dr. Ure's Dictionary) something as to the manufacture of silkworm-fishing-gut; all my trials failed of producing a *strong* line. Of what strength should the vinegar be? How long must the worms be kept in it? At what particular stage of maturity must the worm be put into the vinegar?

I hope you will not consider this deficient in that sort of interest which will confer a place in your columns, and I shall anxiously look for some notice of my queries, which, if answered favourably, will, I doubt not, lead to very important results.

I have seen with regret that at Malta the experiment has failed, through the unfavourableness of the climate.

I have had the pleasure of forwarding these worms to Tobago, Trinidad, St. Vincent, Dominica, and Martinique; they were sent to the latter place by request of its governor. All are anxious to learn whether the silk can be sold in your markets, and all are convinced that any quantity can be cheaply raised as soon as they are satisfied that it will be worth while.

I am, Sir,
Yours very truly,
JOHN WELLS.

Mount Pleasant, Grenada, West Indies,
November 23, 1855.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Architects, 8, Mr. C. H. Smith, "Remarks on the Forms, Methods of Casting, and Ringing of Large Bells, with some suggestions on the subject."
Geographical, 8½, 1, Lieut. Maury, U.S. Navy, "Notice on the Proceedings of the U.S. ship-of-war *Vincennes* to the North of Behring's Strait;" 2, Dr. E. K. Kane's "Report to the Secretary of the United States Navy, on his search for Sir John Franklin, during the years 1852-53-54, accompanied by a Chart showing the Discoveries made during the course of that Expedition; 3, "Note on the further progress of Dr. Vogel in Central Africa."
Tues. Civil Engineers, 8, Mr. J. M. Heppel, "On the relative proportions of the top, bottom, and middle webs of Girders and Tubes."
Linnæan, 8.
Pathological, 8.
Wed. Society of Arts, 8, Mr. Charles Atherton, M. Inst. C.E., "On Tonnage Registration."
Ethnological, 8½.
Thurs. Antiquaries, 8.
Royal, 8½.
Fri. Asiatic, 2.
London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January 4th*, 1856.]

Dated 26th November, 1855.

2656. Denis Jouquet, 63, Mina-road, Old Kent-road—Improvements in the blades of mechanical cutting machines, and in the blades of single or double-handled cutting instruments, and in the blades of ordinary and mechanical shears and scissors, and in the handles and springs for the same.

Dated 28th November, 1855.

2683. Charles Jean Baptiste Barbier, Paris—Improved kiln for burning or firing pottery, bricks, tiles, and other earthenware.

2685. Benjamin Rosenberg, New Charles-street, City-road—Improvements in protecting metallic and other surfaces from corrosion and decay. (A communication.)

2687. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of sand, emery, and glass papers, and in the machinery employed therein. (A communication.)

2689. Samuel Wolff, Independence, Jackson County, Missouri, U.S.—Improvements in obtaining motive power.

2691. Charles Clarke, Farm-lane, Walham-green, Fulham—Improvements in applying roughness to the feet of horses.

Dated 29th November, 1855.

2693. Thomas Symons, Flushing, Cornwall—Improvements in the permanent ways of railways, and in the wheels rolling thereon.

2697. Alfred Vincent Newton, 66, Chancery-lane—Improved process of manufacturing hats. (A communication.)

2699. Pierre Louis Bergeon, Paris—Improved spitting-box or spittoon. (A communication.)

Dated 30th November, 1855.

2701. Henry Thomas Humphreys and James Loughry, Kilmacow Mills, Waterford—Improvements in machinery or apparatus for cleaning wheat.

2703. Auguste Dusautoy, Boulevart des Italiens, Paris—New and useful machinery for cutting cloth and other substances.

2705. Edward John Davis, 64, West Smithfield—Improvements in preparing food for horses and other animals.

Dated 1st December, 1855.

2707. Edmund Alfred Pontifex, Shoe-lane—Improvements in furnaces.

2709. William Needham and James Kite (Secundus), Vauxhall—Improvements in machinery or apparatus for expressing liquids or moisture from substances.

2713. William Augustus Woodley, Taunton—Improvements in the manufacture of paper bags.

Dated 3rd December, 1855.

2715. David Anderson, Strandtown-house, Down, Ireland—Improvements in machinery or apparatus for the preparation or manufacture of felt and other fibrous materials.

2719. William Rowan, Belfast—Improvements in steam-engines.

2721. Alexander Watt, 83, Dean-street, Soho—Improvement in coating iron and steel with zinc.

Dated 4th December, 1855.

2723. Samuel Garn, Sevenhampton, Wiltshire—Improved tipping apparatus applicable to carts and other vehicles.

2727. Joseph Barling, 7, High-street, Maidstone—Improvement in the manufacture of paper by the application of a root not before used for the purpose.

2729. William Knight, St. Marylebone—Improved mode of cutting out or shaping materials to be employed in making overcoats or other similar articles of dress.

Dated 5th December, 1855.

2731. Adam Bullough, Blackburn—Improved lubricator for looms.

2733. William George Plunkett, Belvidere-place, Dublin, and John Bower, Lower Ormond Quay, Dublin—The manufacture of fibres or threads for textile fabrics and cordage, also of paper, mill-board, and other similar boards, from plants or portions of plants not hitherto used for these purposes.

2737. Cæsar Heilmann, 22½, Milk-street, Cheapside—Improvements in grates or furnaces for steam-boilers.

Dated December, 18*th*, 1855.

2858. Christian Rudolph Wessel, 25, Fitzroy-square, New-road, and George Bowden, Little Queen-street, High Holborn—Joining elastic webbing into indissoluble bands.

2860. John Pierrpont Humaston, Newhaven — Improvements in instruments for composing and transmitting telegraph messages.

2862. David Lloyd Price, Beaufort, Brecknock—Improvements in electric telegraphs and in appliances connected therewith as applied to railway trains and fixed stations.

2864. Hiram Hyde, Truro, Nova Scotia—Improved mode of purifying alcohol or alcoholic spirits. (A communication.)

2866. Edward Davies and John Milne Syers, Liverpool, and Charles Humfrey, Camberwell—Improvements in distilling resinous, bituminous, fatty, and oily matters, and in the treatment of certain products therefrom.

2868. Frederick Robert Augustus Glover, Bury-street, St. James—Improvements in the construction of breakwaters, sea-walls, and other structures or foundations which lie partially or entirely under water.

Dated 19th December, 1855.

2870. George Ross and Thomas Wilkes, Birmingham—Improved machinery for the manufacture of bolts, rivets, spikes, screw-blanks, screws, nuts for screws, and washers.

2872. John, Henry, Frederick John, and Charles Staunton Hadden, Nottingham—Improvements in circular frames for the manufacture of ribbed fabrics.

2874. Henry Robert Abraham, 11, Howard-street, Strand—Improvements in carriages, and in certain appurtenances and appendages which belong to those used as hospital conveyances or ambulances.

Dated 20th December, 1855.

2876. Robert Walker, Eccleston, near Prescott—Improvements in applying power to and in machinery for raising and lowering coals and other articles from and into mines.

2878. Andrew Shanks, 6, Robert-street, Adelphi—Improvements in instruments for indicating pressures.

2882. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in machinery for splitting leather. (A communication,)

2884. John Barcroft, Hanley, Stafford—Improvement in the materials to be used in the manufacture of baskets and basket-work.

2886. Louis Rudolph Bodmer, 2, Thavies-inn—Improvements in hydraulic seed-crushing machines or oil-presses.

Dated 21st December, 1855.

2888. Jean Baptiste Emile Saffroy, Bordeaux—Improved break for railway carriages. (A communication.)

2890. Thomas Edward Merritt, Maidstone—Improvements in breech-loading ordnance and fire-arms.

2892. Matthew Tomlinson, Ivy-house, Culcheth, Lancaster—Improved medical plaister.

2894. James Murdoch, 7, Staple-inn—Improvements in machines or apparatus for working chain-stitch embroidery. (A communication.)

2896. Henry Francis, 456, West Strand—Improvements in apparatus for cutting out parts of garments.

2898. William Joseph Curtis, 1, Sebbon-street, Islington—Improvements in fog signals, and in laying the same upon the rails of railways.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 4th, 1856.

1500. George Guillaume.
1501. Georges Antoine Tabourin.
1534. Henry Crosley.
1547. James Hall Nalder.
1624. Robert Martin and John Cowdery Martin.
1680. Richard Archibald Brooman.
1682. Thomas Hewitt.
2060. James Higgin.
2492. Richard Threlfall and John Higson.
2546. John Henry Johnson.

January 8th.

1536. John and Anton Bruno Seithen.
1537. François Loret-Vermeersch.
1541. Richard Archibald Brooman.
1553. Julius Jeffreys.
1554. John Adams.
1556. William Williams.
1567. Charles Byrne.
1574. Eugène Gillet.
1583. Louis Constant Joseph Poliesse, junr., and Charles Auguste Joseph Lengelée.
1593. Jean Baptiste Piscal.
1595. James Newman and William Whittle.
1616. John Ellis.
1621. Auguste Edouard Loradoux Bellford.
1626. Samuel Barlow Wright and Henry Thomas Green.
1649. Peter Armand le Comte de Fontaine-Moreau.
1655. Samuel John Pittar.
1705. William Mardon.
1831. Lewis Normandy.
1963. William Gossage.
2089. Lewis Dunbar Brodie Gordon.
2129. Joseph Beattie.
2135. Alfred Vincent Newton.
2158. Josias Nottidge.
2168. James Good.
2175. Joseph Beattie.
2220. Edward Meldrum and James Young.
2247. William Edward Newton.
2337. Doctor Graham.
2347. Henry Giller.
2381. John Edwin Mayall.
2390. Joseph Robinson.
2405. Edwin Tomlinson and Alfred Mortimer Job.
2443. Robert Kerr.
2479. William Henly Walenn.

Patents on which the Third Year's Stamp Duty has been Paid.

December 27th.

19. George Gwynne and George Fergusson Wilson.

December 28th.

1186. John Copling, junior.
1192. Archibald Douglas Brown.
11. John Bleackley, junr.

December 29th.

21. Jean Baptiste Pascal.

December 31st.

41. Peter Graham.
92. William Brown.

January 1st.

39. William Edward Newton.
125. Peter Fairbairn and Samuel Renny Mathers.
189. Alfred Vincent Newton.
240. William Edward Newton.

Journal of the Society of Arts.

FRIDAY, JANUARY 18, 1856.

SIXTH ORDINARY MEETING.

Wednesday, January 16, 1856.

The Sixth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 16th inst., Capt. J. M. Laws, R.N., in the chair.

The following Candidates were balloted for and duly elected :—

Bleekrode, Professor
Clark, Joseph Lester
Dixon, Thomas
Evans, Frederick Mullett, jun.
Labalmondiere, George

The following Institutions have been taken into Union since the last announcement :—

408. London, Eastern Counties Railway Mechanics' Institute and Stratford Literary Society.
409. Prees (near Shrewsbury), Mutual Improvement Society.

The Paper read was :—

ON TONNAGE REGISTRATION.

By Charles Atherton, Member of the Institution of Civil Engineers, and of the Society of Arts, Chief Engineer Royal Dockyard, Woolwich.

In a paper read before the Society of Arts on the 16th of May last, the capabilities of steam ships as locomotive machines for the conveyance of mercantile cargo, were subjected to investigation. In that paper, the mutual relation of displacement of the ship, working power of the engines, and speed realised, was taken as the elementary base of calculation, whereby the relative locomotive efficiency of different types of vessels constructed for the purpose of goods transport service might be compared; and the importance of the inquiry was demonstrated by showing the great difference in point of pecuniary economy that actually exists between ships of different type of build, though both of ordinarily good repute, when put to the test of performing a specific service by the agency of steam alone: this was exemplified by investigating the results of performing a given service by vessels of certain definite and actually existing types of build, and it was shown that a difference of constructive type, almost inappreciable to common observation, might enhance the cost of freight 100 per cent. and upwards. This result, as set forth in the former paper, is now referred to for the purpose of keeping in view the commercial £ s. d. importance of the subject. The practical object of the investigation now proposed for further discussion may be summed up as follows: namely, to determine what steps are necessary to be taken in order that tonnage registration may embrace the elementary data by which the locomotive qualities of ships may be comparatively determined and duly appreciated, and whereby especially those general principles of construction and types of build may become adopted which are most conducive to transport economy, and, therefore, it may be presumed, most beneficial to the public interests. In the former paper the question of engine-power in reference to steam ships was disposed of, by exposing the utter vagueness of the term "nominal horse-power" in our present commercial practice, and pointing out the necessity for some definite measure of power being recognised in official registration, as the legal standard measure of the unit of power to be denoted by the term "marine horse-power;" we now come to that division of our subject which is especially proposed for investigation in this paper, namely. "Tonnage Registration." In the first place, let us inquire what is the meaning of the term Tonnage, as made use of in shipping-registration under the now existing law, namely, the Mercantile Shipping Act of 1854; what matter-of-fact or measurable reality does the term *tonnage* signify; has the *tonnage* of a ship any specific relation either to the displacement of the ship or to the nett tons weight of cargo that a ship will carry, or to the quantity of cargo that a ship will hold? does the registered *tonnage* correctly answer any purpose as the base of calculation in commerce, or as preventing fiscal imposition? does it equitably constitute the base of building contracts; or answer any useful purpose in scientific inquiry, as affording elementary data available for determining the relative locomotive merits of ships? Finally, does the registration of *tonnage*, under the existing law, afford any information whereby cupidity and recklessness in the loading of ships can be officially exposed or checked in a manner conducive to the safety of property and life? Such are the points which we purpose inquring into, and if the present system of Tonnage Registration does not fulfil these requirements, it is purposed to submit for the consideration of the Society such suggestions as may conduce to the attainment of those objects.

Preparatory to entering upon these inquiries, with reference to the existing law for regulating the measurement of tonnage, as embodied in the Merchant Shipping Bill of 1854, it may be well to refer summarily to the preceding various enactments which have been enforced for regulating the admeasurement of shipping, show what *tonnage* originally meant, trace the various changes which have taken place in the law of tonnage, and scrutinise the grounds on which from time to time such changes appear to have been introduced. Mr. Moorsom, in his "Review of the Laws of Tonnage," has collated the various legislative enactments bearing on this subject.

It appears that the necessity for placing the loading of colliers under legal restriction attracted the notice of the legislature in 1422, the ninth year of the reign of King Henry V., when it was enacted that "keels that carry coal at Newcastle shall be *measured* and *marked*." No further legislative notice appears to have been taken thereof till 1648, when, by Act 13th Charles II., it was enacted, "That commissioners should from time to time be appointed, for the *admeasuring* and *marking* all and every the keels and other boats to be used for the carriage of coal in the port of Newcastle, and all other places within the counties of Northumberland and Durham." It does not appear to have been specified, either by 9th Henry V. or 13th Charles II., what was to be the precise principle and method of admeasurement and marking thus enforced; but subsequently, in the year 1694, by Act 6th and 7th William and Mary, it was enacted that "the admeasurement shall be by a dead weight of lead or iron, *allowing three and fifty hundred-weight to every chaldron of coal*," and that "the said keels and boats so admeasured should be *marked* and *nailed* on each side of the stem and stern and midships thereof." Thus, in the year 1694, a complete system was established whereby the nett *chaldronage* of the Northumberland and Durham colliers was indicated by ostensible marks on both sides of the stem, stern, and amidships, which system of admeasurement was afterwards extended to vessels used in loading coal at "all other ports of Great Britain," the vessels, as before, to "be admeasured by a dead weight of lead or iron, allowing 20 hundred-weight avoirdupois to the TON, and marked and nailed as aforesaid, to denote what quantity of coal each will carry up to the mark so set thereon." Thus, instead of the cargo being denoted, as previously, by chaldrons of coal rated at 53 cwts. per chaldron, the marks on both sides of the stem, stern, and midships were now made to denote Tonnage of cargo at the rate of 20 cwts. avoirdupois to the ton,—practically determined by placing on board such weights of lead or iron, and the corresponding marking or nailing at the water's surface, being made accordingly. The Acts above referred to relate exclusively to craft engaged in the coal trade in British ports; but, in 1720, it was determined to bring vessels engaged in the foreign spirit trade within the operation of the tonnage laws, and accordingly, in 1720, by Act 6th George I., it was enacted that the following rule for determining the admeasurement of ships laden with brandy and other spirits shall be observed, that is to say:—"Take the length of the keel within board (so much as she treads upon the ground), and the breadth within board by the midship beam, from plank to plank, *and half the breadth for the depth*; then multiply the length by the breadth, and that product by the depth (or half the breadth), and divide the whole by 94: the quotient will give the true contents of the tonnage."

By this Act of 1720, 6th George I., the registered tonnage had no longer any direct reference to the weight that would actually sink the vessel down to any specific line of draught; no legalised limit is assigned to the draught of water, and, consequently, there is no prescribed limit to the *weight* of cargo that may be shipped on board short of that which will sink the ship; moreover, the real depth of the hold of the vessel may be either greater or less than the half-beam; consequently, the rule affords no criterion whatever even of the internal capacity or roomage of the vessel, nor yet of the *quantity by measure* that the ship might hold. It is possible that, with reference to some one proportion of build, or to the usual practice of ship-building at that time, the resultant of the prescribed rule may then have been a number corresponding either to the number of tons weight that ships may have carried at their usual deep-draught immersion, or possibly the resultant of the prescribed rule may then have given a number corresponding to a certain amount of measurement tonnage rated at 40 feet, or some other conventional number of cubic feet to the ton; but whether *bulk* of cargo or *weight* of cargo was intended to be embraced by this law of tonnage is not stated, and as regards its general application to the measurement of dissimilar vessels, the rule is merely an arbitrary combination of figures, devoid of all mathematical principle as a rule of admeasurement, resulting in a number that is called tonnage, but, nevertheless, not necessarily representing, even approximately, either the internal roomage for cargo, or the tons weight of cargo that a ship would carry, or to which she might be restricted. It is to be observed, that the abortiveness of the above rule, as prescribed in 1720, by Act 6th George I., is chiefly attributable to the limitation of the deep draught by *nailing* having been abandoned, and to the *depth* of hold having been discarded from the calculation, by half the breadth having been assumed in lieu thereof. This Act, 6th Geo. I., was the origin of all the now tap-rooted delusion in regard to tonnage which subsists in Britain even up to the present day. Be it observed, that the French never adopted this absurdity of attempting to compare the cubature of dissimilar bodies by taking cognizance of two dimensions only.

We now come to the year 1773, Act 13th Geo. III., when the legislature deemed it expedient that one certain rule should be settled and established, and applied in all cases where the tonnage of ships or vessels trading to or from this kingdom was necessary to be known or ascertained, still excepting the vessels used in carrying coal and those employed in the British white-herring fisheries. Accordingly, in 1773, by Act 13th Geo. III., c. 74, the general rule for the admeasurement of ships or vessels was prescribed to be as follows:—"The length shall be taken on a straight line along the rabbet of the keel of the ship, from the back of the main stern-post to a perpendicular line from the forepart of the main stem under the bowsprit, from which subtracting three-fifths of the breadth, the remainder shall be esteemed the just length of the keel to find the tonnage; and the breadth shall be taken from the outside of the outside plank in the broadest place in the ship, be it either above or below the main wales, exclusive of all manner of doubling planks that may be wrought upon the sides of the ship; then multiplying the *length* of the keel by the *breadth* so taken, and the product by *half the breadth*, and, dividing the whole by 94, the quotient shall be deemed the true contents of the tonnage." By this act of 1773, 13th Geo. III., we have *external* measurement substituted for the previous *internal* measurement, but still it was not stated whether tonnage was intended to signify *weight* of cargo or *space* for cargo; also, no direct cognizance is taken of depth, half the breadth being taken in lieu thereof, and no limitation is assigned to the draught, thus the fundamental errors and deficiencies of 6th Geo. I., were continued and confirmed by 13th Geo. III. Subsequently, in 1786, it was enacted by 26th Geo. III., c. 60, "that, in the case of measuring *vessels afloat*, the length shall be taken at the *load water-line*, from the back of the sternpost to the front of the main stem, 'subtracting therefrom 3 inches, for every foot of load draught of water for the rake abaft, and three-fifths of the ship's breadth for the rake forward, the remainder being the length of the keel for tonnage.'" The rest of the rule was continued as before. Here we have the load-water line referred to, but the position of the said load line below the deck, with reference to the beam of the vessel or other limitation, is not specified. And again, in 1819, by Act 59 Geo. III., c. 5, it was enacted, "that in the rules established for the admeasurement of ships, when used for ascertaining the tonnage of any ship or vessel propelled by STEAM, the length of the engine-room shall be deducted from the length of the keel for tonnage, the remainder being esteemed the just length of the keel to find the tonnage." Hence it will be perceived, that the Act of 1773, and the extensions thereof of 1786 and 1819, took no direct cognizance either of the deep draught of water of the vessel or of the depth of hold; it was only length and breadth that were recognised as elements in the admeasurement of tonnage, and, consequently, the rule cannot be a correct, or even a comparative measurement of dissimilar vessels, either as respects displacement or internal roomage. Nevertheless, the rule was adopted, and devices were resorted to by shipping proprietors for taking advantage of the defects of the law, in such manner that the real capacities and capabilities of ships for cargo, whether by weight or measurement, might greatly exceed the nominal tonnage by which fiscal dues on shipping were usually regulated. The law thus afforded a suicidal protection to British shipping, for to such length were these evasions carried, that they induced the construction of dull sailing vessels, highly detrimental to public interests, so much so that, in 1821, the public evils induced thereby again attracted the attention of the legislature, and a commission was appointed to inquire into the subject. The commissioners reported, in 1821, that "there are sufficient reasons for being dissatisfied with the mode of admeasurement now legally employed;" that "they would have been desirous of removing all doubt on the subject, by proposing the admeasurement of *that portion of the ship which is included between the light and heavy water-lines*," but "this method has been considered as liable to insuperable objections, on account of the impossibility of ascertaining the positions of these lines in a satisfactory manner;" and they proceeded to propose the adoption of an entirely new method of measurement and computation of tonnage, based on *internal* measurement, but the proposed amendments were not adopted by the legislature, and the old laws continued in force. Again, in 1833, a second commission was appointed "to consider the best means of measuring the tonnage of ships." The commissioners, in their report of 1834, state, that the "internal capacity will be the fairest standard of measurement, including all those parts of a vessel which, being under cover of permanent decks, are available for stowage," and, "that a rule of such general application should depend on the smallest number of measurements necessary to give the figure of the hull, and that it should afford results sufficiently exact for the required purpose by an easy arithmetical process."

Two rules based on *internal* measurement were prescribed by this Committee of 1833, namely, rule No. 1, for the measurement of vessels for register tonnage while the hold is *clear;* rule No. 2, for the measurement of *loaded* vessels. These rules were legalised in 1834, by Act 5th and 6th William IV., c. 56, amended by 6th and 7th Victoria, c. 84, and consolidated by 8th and 9th Victoria, c. 89. Thus a new system, based on *internal* admeasurement, and intended to totally supersede the old law, 13th Geo. III., c. 74, now became legalised; nevertheless, whether from the complexity of the new rules as compared with the old law, or the difficulty of introducing any change in long established usage, these new rules failed to give satisfaction; the old law, though repealed, continued to be generally acted upon as the base of shipping operations, and the new law being thus inoperative, Government, in 1849, instituted a third commission, for the purpose of inquiring into the defects of measuring ships for tonnage, and to frame a more perfect rule. This third commission reported as follows:—"That the equitable basis on which charges for dock, light, harbour, and other dues should be made, is that of the entire cubic contents of all vessels measured *externally*," and "that inasmuch as the poop, forecastle, and other covered-in spaces, are directly or indirectly a source of earnings from cargo or passengers, those spaces should be all measured." Accordingly, the rule proposed by this, the third commission, included the *external* bulk of the vessel up to the medium height of the upper side of the weather deck. It was proposed that this cubical mensuration of the vessel should be divided by 35, thus giving the total displacement in tons weight, supposing the vessel to be immersed down to the medium height of the weather deck, and that the quotient should be multiplied by the factor ·27, in order that the new register tonnage of ships might, on the average, accord with the register tonnage under the old law; also, for the measurement of vessels *afloat*, a system of girting the vessel was proposed. These proposed rules of the third commission were not favourably received by the shipping interests, and were not adopted by the legislature, consequently, the rules proposed by the second committee, called the new admeasurement, as legalized in 1834, by Act 5th and 6th Wm. IV., c. 56, consolidated 8th and 9th Vict., c. 89, continued to be the law of the land; but, nevertheless, the old law of 1773, 13th George III., though thus repealed, continued to be generally received and acted upon in commercial arrangements, especially as the base of tonnage measurement in ship-building contracts.

We now come to the fourth commission, appointed for revision of the tonnage law and for the consolidation of the various Acts relating to merchant shipping, resulting in the Merchant Shipping Bill of 1854, 17th and 18th Victoria, c. 104.

Under this Act of 1854, a system of tonnage admeasurement based on internal capacity, but reduced by a factor (divisor 100) in order that the aggregate of tonnage, as measured by this new law, might correspond with the aggregate if measured by the old law, has now become the law of the land; and although this commission commenced its labours under the avowed and recorded declaration, "that it is desirable to establish an easy practical mode of admeasurement," the specification merely of the outline of the system of admeasurement as prescribed by this bill of 1854, occupies no less than ten clauses in the Act; and the detail of working out the calculations, to be properly understood and not done by rote, demands a course of laborious mathematical study. This system being merely the application of mathematical routine to the cubature of bodies, its accuracy may be admitted, but the prescribed detail of instructions to meet various sizes of ships and various peculiarities of construction, have been made so multifarious as to complicate the application of the system, and to render the practical operation whereby the results are obtained a mystery, unintelligible to every body excepting those who make it a professional study. It has already been felt that this law of admeasurement as respects its application to *ordinary* mercantile purposes is, by reason of its complication, abortive, and, consequently, the simple rule of the old law of 1773, 13th George III., denominated "builders' measurement," with all its glaring defects, still continues to be almost universally recognised as the base of mercantile contracts for the purchasing and building of ships. Such is the history of tonnage down to the present time.

It is not proposed at present to take exception to the system of internal measurement as prescribed by the Merchant Shipping Bill of 1854, merely on account of the complications which have thus been made to attend its practical application. The question now raised is one of PRINCIPLE, namely, whether or not the measurement of *internal roomage only* being made the base of "tonnage" is of itself effective for the attainment of the objects for which tonnage registration has been established. This brings us back to the various points of inquiry proposed for consideration in the first part of this paper. *Firstly*, then, what is the meaning of the term "*tonnage*," as made use of in the Merchant Shipping Bill of 1854? The Act itself does not specifically define whether weight or measure is intended to be signified by the term tonnage; but, by a recorded resolution of the commission, we find it to have been their avowed object to "produce as nearly as possible, the same results as under the former system of admeasurement commonly termed, the Old Law or Builders' Measurement;" that is to say, that after having taken infinite pains for accurately measuring the roomage of ships, the reduction of this roomage measurement should be such as would produce the same amount of aggregate *nominal tonnage* as by the old law; to attain which result it is found necessary to divide the roomage taken in cubic feet by the factor or divisor 100, so that if the old law falsified the aggregate tonnage of the country, the new law would perpetuate the error. Now, the old law took no direct cognizance whatever of the *draught of water* of a ship either light or loaded; and, consequently, it did not measure the capability of a ship for carrying weight. Hence it follows that tonnage, under the new law, has no reference whatever to the tons weight which a ship will carry, but means that a ship of given tonnage has the available internal capacity of 100 cubic feet for each ton of such *nominal tonnage*. Hence, tonnage, under the new law, means simply roomage; then, why not call it roomage? The very term *tonnage* implies the capability of a ship for carrying *weight* burden; but one may as well talk of a ton of time, or of a ton of distance, as of a ton of space or roomage, unless a specified measure of space be conventionally appropriated to the term "ton," and there is no conventional usage in commerce which appropriates 100 cubic feet of space or roomage as the unit of goods measurement for freight. A proper nomenclature in the registration of shipping, is undoubtedly indispensable to system and efficiency in conducting shipping operations.

Secondly.—Does the adoption of internal measurement as the base of registration constitute, as it is professed to do, any guarantee or inducement to builders tending to improvement in the form and build of shipping? It is no argument of mine whether or not one system of admeasurement more than another would so far influence builders as to induce the building of a good or bad form of vessel, or the using of a greater or less quantity of material in the construction of a ship of specified size—I disclaim all such inference; but, as it has been urged that the system of internal measurement would in these respects conduce to public good more than any other system of admeasurement; and as the perfect efficacy for good, of internal measurement, has by its advocates been presumed to be proved simply because extreme cases of other systems may have been by them logically run down to the "*reductio ad absurdum*," I would merely notice that as regards the forms of ships, a given amount of material would produce the greatest amount of internal roomage by adopting a hemisphere as the form of the ship; but as the hemispherical hull would, in point of workmanship, be a very expensive form, it would be still more to the interest of the builder, who should unworthily allow himself to be influenced by the temptation afforded by internal measurement to make a ship of specified size at the least cost, to adopt the Tub as his type of build,—and surely between the "*reductio ad absurdum*" and the "*reductio ad Tub*," there is not much to choose. I, therefore, do not admit that the adoption of internal measurement as the base of tonnage does of itself, necessarily, induce an improved type of build, as respects either form or strength, as has been so strongly urged in favour of that system by its advocates; and as regards the assertion that internal measurement would afford the best security for the equitable rating of fiscal dues, I would also question this result by observing, that a ship might be constructed on the cellular principle of build, as adopted in the great leviathan iron vessel now building on the Thames, carrying this principle of build to such extent, that in a vessel measuring 35,000 cubic feet, or 1000 tons displacement between the light and load draught water lines, the hold of the vessel might measure only 10,000 cubic feet. Such a vessel would both stow and carry 1000 tons weight of pig iron, railway bars, or such like goods, but her tonnage by the prescribed rule of internal measurement, at the rate of 100 feet per ton, would be 100 tons, being only one-tenth part of her weight cargo. Again, on the contrary, 1000 tons of cotton or wool would probably require 160,000 cubic feet of internal roomage, that is, a ship of 1600 tons nominal tonnage—thus, the 1000 tons of cotton or wool would be charged with sixteen times the amount of ship's tonnage dues that would be paid on the 1000 tons of iron, unless, indeed, in both cases, we adopt the principle of the raft, in which case, placing the cargo on deck, the tonnage would be 0. We may, therefore, under the present law of internal measurement, have a floating mass of any form, possessing but little, if any, internally measurable space; in fact, a ship without tonnage, but I have not yet learnt that a floating mass can exist without externally measurable bulk; it is, therefore, not admitted that internal measurement necessarily insures fiscal justice.

Thirdly.—Does registration, based on internal measurement, pre-eminently above all other systems of measurement, afford elementary data of any use towards determining the relative *locomotive* MERITS of ships? On this point, as the details of *internal* measurement afford no record of *external* length, breadth, or draught of water, such measurement does not necessarily afford a measure of the displacement; and as displacement is an essential element in determining the relative locomotive merits of ships of different size and type of build, I do not perceive in what respect a record based on internal measurement only would facilitate scientific analysis, or afford the means of testing the *comparative* adaptation of different types of build for easy propulsion by steam or sail.

Fourthly.—Does the present law of registration, based only on internal measurement, afford any data tending to check the loading of ships to such extent as might endanger the safety of property and life? The importance of this point of consideration cannot, in my opinion, be more strikingly exemplified than by reference to the official returns of shipwrecks on the shores of Britain. The aggregate of the annual loss of life and property by shipwreck, would not fail of striking the public mind with awe if publicly made known. It is much to be regretted that greater publicity is not given to the catalogue of annual shipwrecks of British shipping, in order that public opinion might be brought to bear on the correction of this the most monstrous of our national calamities, but the least thought of because of daily occurrence, and only made known in detail. The following summary is taken from the report of the Committee on Life-boats, originated by his Grace the Duke of Northumberland, in 1851:—

"From official returns, it appears that in the course of the year 1850, no less than 681 vessels were wrecked on the coasts and within the seas of the British Isles. Of these vessels, 277 were total wrecks, 84 were sunk by leaks or collisions, 16 were abandoned, and 304 were stranded or damaged so as to require them to discharge cargo, and, as nearly as can be determined, 780 lives were lost."

It will not, I presume, be doubted, that the too deep loading of ships constitutes one of the greatest sources of danger to which a ship can be exposed. Let us examine, then, whether internal measurement affords any check on such abuse. Now, measuring up to the very gunwales of a ship, it is not unusual for the internal roomage to be about 80 per cent. of the external cubature of a timber ship, and still more in an iron ship. Consequently, a timber vessel of 70,000 feet external cubature may have 56,000 feet of internal roomage. The total displacement of such a vessel, when immersed down to the deck level, would be 2,000 tons weight, and allowing 600 tons for the weight of the vessel herself, the sinking weight of cargo would be 1,400 tons weight, consequently, the vessel would sink if filled with a description of goods heavier than one ton weight to the 40 feet of cubic measure; but many descriptions of goods may be stowed at the rate of two tons to the 40 feet of cubic measure, therefore, with such a cargo, the vessel might be loaded down to the very gunwales, and be in a sinking condition when only one-half full. These figures have been adduced to show the liability of ships to be heedlessly overloaded, unless the LAW define some rule for regulating the *deep draught limit*, which check against the overloading of ships the present law does not afford. The nominal tonnage of the ship above cited, containing 56,000 feet of internal roomage, would indeed be rated at 560 tons register tonnage, but the law does not restrict the weight cargo of ships to their register tonnage, or to any other limit,—and such being the case, what is to prevent the point of safety from being exceeded? The effect of insurance only tends to increase the evil. A dangerously loaded ship, if well *insured*, may be regarded by the owner ashore with indifference as to the consequence of a raging storm. If a man purposely set fire to a house, and death ensue, he will certainly be amenable to the law; but a well-insured ship may be recklessly overloaded, and sunk with impunity and profit. Our present system of registration affords no check on such abuse. Why should the law regard arson as a crime while it imposes no limit to the loading of ships to such an extent that they may become unmanageable, and in danger of foundering if bad weather ensue? Yet such is the case, and the anomaly is the more striking, inasmuch as the victims by wreck at sea are probably 100 times more numerous than the victims by fire on shore.

Again, let us consider the active and publicly protective supervision of the legislature over railway management as compared with the same supervision over shipping. Happily for the public, public safety is vindicated by the strict investigation to which the occurrence of accident by railway is subjected, and who can estimate the amount of prevention of accidents which such official scrutiny into railway management is sure to create? We may, merely for exemplification of the details of government scrutiny in matters of railway management, refer to the report of the railway department of the Board of Trade on certain railway accidents in June, 1855. The subject matter of this report was regarded of such import as to be printed by order of government, to be presented to both houses of Parliament in August last, and it consists of the following cases:—

1st. An accident whereby one person was injured.

2nd. An accident tending to public danger, but by which, fortunately, only a carriage was injured.

3rd. An accident whereby one person was killed.

The small amount of personal injury consequent on these three accidents thus brought before the special notice of government by the Board of Trade, show the great importance that is most deservedly attached to the prevention and correction of defects in railway management.

The official investigation consequent on the accidents above-referred to, involved numerous details of railway management; for instance, the relative positions of ticket platforms, adjacent junctions, and signal stations, are all measured off to a foot and criticised, the habitual management of the traffic is inquired into, the practical operation of the machinery for working signals, points, and tongues, examined, the number of hands employed as pointsmen and signal men ascertained, also the number of waggons employed, and their loading, with reference to the numbers, power, and efficiency of the accompanying break, was fully investigated. The above enumerated details of inquiry with reference to these accidents exemplify the nature of government action in railway affairs for the protection of life. How strangely, then, does this detailed and scrutinising supervision of government over railways contrast with the fact that the deep draught of a ship, on which safety at sea so much depends, is left to the caprice of parties whose pecuniary interest consists in loading a ship to the utmost, and able to do so, there being no legalised limitation assigned thereto, no record taken thereof when a vessel leaves port, and no means of proof on this most vital matter available for judicial inquiry in the case of a ship foundering at sea with 500 souls on board. How strange is the contrast that the three railway accidents which occurred in June, 1855, involving the death of one person, the injury of another, and the breakage of a carriage, should thus be the subject of special report to both Houses of Parliament by command of her Majesty, whilst no official notice whatever has been taken of the 228 cases of shipwreck said to have occured in January of the same year. Further amplification on this subject, by quoting the fate of the *President* and 50 other instances of wholesale loss of life by the foundering of ships at sea, would be too painful an inquiry to be reagitated; it is hoped that mere allusion to such catastrophes will suffice, and by showing that these glaring and homicidal deficiencies of shipping registration do not pass unobserved, it is hoped that the evil may attract attention and its remedy be provided.

We now come to the point what is best to be done, in order that the registration of shipping may give not only the internal cubature, but embrace other matters of fact conveying information of commercial utility, conducive to the scientific improvement of shipping as locomotive machines, and to the protection of property and life. The question is public, open to perfect freedom of opinion, and there is no subject of inquiry more worthy of the Society of Arts.

In the first place, it may be observed, that the capability of a ship for carrying weight is a totally different thing from the capability of a ship for holding bulk—the one is no measure or indication of the other. A ship may be actually sunk with some descriptions of cargo before she is half full, and with other descriptions of cargo the same ship may be full before she is half loaded. The glaring deficiency of the Tonnage Registration Law has hitherto consisted in this—that it has never been expressly defined whether the legal signification of tonnage implies the capability of a ship for carrying weight, or the capability of a ship for holding bulk, and for want of such legalised definition of the term tonnage, men have been in the habit of applying to the term whatever signification may have best suited the interests and requirements of their own business. For instance; one merchant may expect a ship of 1000 tons register tonnage, to carry at least 1000 tons weight of cargo; another may expect her to carry at least 1000 tons measurement of light cargo, at the usual conventional measurement of 40 cubic feet to a ton. A shipowner claims the privilege of charging his freight either by the *weight* or by the *measurement* of the goods to be conveyed, as may best suit his interests; and again, the ship-builder still rates his building price per ton of tonnage as measured by the old law, without being thereby bound either as to what the ship shall carry, or what the ship shall hold, unless he specifically engage relative thereto. Thus, we have tonnage applied in four different significations, and implying as many totally different meanings. It is thus a conventional term, signifying anything, but defining nothing; truly, a fine field for commercial cleverness in the buying, selling, freighting, and chartering of ships. Is such a sham, especially in time of war, compatible with public good? Yet on the deficiencies of the present system of shipping registration being asserted, it has been responded that as the SHIPPING INTERESTS have not, by petition to the legislature, objected to the present law, the question of its amendment cannot be entertained. Why, whoever yet heard of any corporation, trade, or profession voluntarily petitioning for the correction of its own system with a view to public good? Was the House of Commons purged of *Borough-mongering* from within or from without? On the popular question of *Free Trade* was not every man a free-trader as applied to every business *except his own?* In Joint Stock Companies, have not twenty per cent. dividends been generally received with acclamation, and sometimes even with testimonials of gratitude? It is only when dividends fail, that the bubble bursts with high-pressure declarations of virtuous indignation, and with demands of enquiry for the detection of abuse. So much for the trading communities. Then, as to the professions of Law, Physic, and even of Divinity. Has Chancery, Lincoln's Inn, or any other corporate personification of the law petitioned for reform with a view to mitigating the legal complications and consequent public plunder connected with the transfer of land? Has any College of Physicians declared itself against continuing the dark-age use of *Dog Latin?* Has Convocation or any other corporate personification of the Church, petitioned for inquiry into the diversion from their intended purpose of Educational and Charity Trust Funds? What right or reason then, have we to expect that the Shipping Interests will voluntarily petition the legislature for an effective system of registration, throwing open the mysteries of their craft with a view to public good? What is the alternative? Is the legislature or is public association to take the initiative as the guardian of public good? If the latter, as seems to be now confessed, the Society of Arts will, doubtless, assume its proper place, and direct the attention of its 400 Associated Institutions to the registration of shipping as conducive to transport economy, which affects the rate of income-tax and the price of bread.

Now, let it be observed, how greatly tonnage ambiguity would be relieved if the capability of the ship for carrying *weight*, expressed in tons weight, were called the "Cargo Tonnage," and the capability for carrying *bulk* cargo at the conventional measurement of 40 cubic feet to the ton the "Roomage," or some other equally distinctive term. Such a registration would be commercially useful, as really expressing the capabilities of a ship for cargo, but let us see what practical difficulties would be involved in obtaining the data for such a record. It may be at once admitted that the system of admeasurement prescribed by the new merchant shipping law gives the roomage of any ship, but as the *weight* cargo would be represented by the displacement between the light draught and the load draught water lines of the ship expressed in tons weight, we are at once involved in the necessity of proposing some rule whereby some limitation of the position of the load line to which a ship may be loaded, shall be legally assigned to every registered ship, which is altogether omitted in the Merchant Shipping Act of 1854. The ship herself, when perfectly equipped for sea and ready to receive her cargo, will show her light draught line of floatation. It is the fixing of some specific limitation to the deep draught line of flotation to which a ship may be fairly loaded, that constitutes the sum, substance, and essence of the whole system of reform in tonnage registration which is now under consideration. The process of admeasurement will be a matter of routine detail, after we have once determined what are the elements which we want to measure to render registration effective.

In the Merchant Shipping Bill of 1854, the routine detail of the admeasurement of one element only—internal roomage—has been minutely elaborated; in this respect, even gnats have been strained at; but the objects which it is essential that registration should embrace with a view to practical general utility of result do not appear to have been considered; internal roomage only has been thought of; in this respect, the camel has been swallowed. Now is it, or is it not, possible to devise some prescriptive rule which may be legally recognised as assigning some limitation to the position of the regulation deep draught line of a ship. We have already seen that in 1422, by Act 9th, Henry V.; also in 1648, by Act 13th, Charles II.; also in 1694, by Act 6th, William and Mary, the deep draught of vessels was officially limited, the vessels were weighed down to such deep draught limit, and *nailed* on both sides of the stem, stern, and amidships, to denote the maximum draught and the actual weight of cargo by which the vessel would be immersed or sunk down to the deep draught mark so nailed thereon. It was only at a comparatively recent period (1720) by Act 6th, George I., that the above system of officially determining and nailing the deep draught lines of ships appears to have been superseded; and the rule adopted for determining the so called tonnage of vessels by reference to the length and breadth only, assuming that the depth would always continue (as might then have been the approved practice) to be some definite proportion of the beam, and assuming also that ships would always continue to be built of the then approved type of form. These assumptions of 1720 have not been perpetuated in Britain, as they might have been in China; but, nevertheless, the principle of tonnage admeasurement founded thereon was confirmed by various Acts, and continued in legal operation up to 1834, and since that time the same system of delusive builders' tonnage, though legally superseded in 1834, has been most tenaciously upheld, even to the present day, for, notwithstanding the new Merchant Shipping Law of 1854, legalising a totally new system of measurement based on roomage, the old law or "builders' measure," as it is emphatically called, still continues to be the base, not only of mercantile, but even of Government contract transactions in the generality of matters appertaining to the purchasing and building of ships. The old "builders' measure" was so easily applied, compared with the system prescribed by the law of 1834, that it could not be thereby rooted out, though manifestly injurious to the public. In China, the practical origin of the law and the continued operation of the law would have been equally upheld; but in Britain we subvert reason by continuing to uphold the consequence after having repudiated the cause; we deride the fixed customs of China, but in this case of tonnage we allow public interests to succumb to the convenience and habit of a class; well may even John Chinaman laugh in his loose sleeve at this half-and-half progress, and consequent self-imposed loss, of blundering, hardworking, pay-for-all John Bull; still, in 1855, the proposed reformation of limiting the capabilities of ships for cargo to any regulation position of the deep draught water line has been declared to be *impracticable*. To assert the *impossibility* of any proposed amendment as our only argument, is a refuge tantamount to an admission of the weakness of the cause thus attempted to be upheld. These are not the days to assert the impossibility of reformation as justifying the continuance of an effete practice. But as respects tonnage registration based on displacement, limited by the deep draught line of a ship, there is nothing impossible in the case; every ship demands that the loading shall cease at some limit of draught or other short of the gunwales or main deck of the ship; and is it right that the party who now determines that limit should be the party who has a direct pecuniary interest in loading the ship down to the utmost verge of floatation that his own interested decision and, therefore, possibly perverted judgment, may dictate? Even supposing it were true that it is "*impossible* to define by legislation the position of the deep draught line in a satisfactory manner," and that it must therefore be left to individual discretion, surely the person directly interested in loading a ship down to the lowest verge of risk, is the last man who ought to be entrusted with such discretionary power. But let us inquire into the practical facts of the case. The fact is, that every ship constructed on scientific principles is built with reference to some determinate limit as the constructors' deep or load draught line of the ship. Take, for example, the catalogues of vessels of which the elements of construction are given in Fincham's "History of Naval Architecture," and we find as follows:—page 248 and following pages, the constructors' "deep draught" water line given in feet and inches both forward and aft for the following list, embracing vessels of every class in the Royal Navy:—*Espiegle*, *Flying Fish*, *Mutine*, *Daring*, *Osprey*, *Cruiser*, *Sapphire*, *Acorn*, *Columbia*, *Wolf*, *Pylades*, *Orestes*, *Champion*, *Calliope*, *Vestal*, *Electra*, *Inconstant*, *Castor*, *Pique*, *Barham*, *Vernon*, *Raleigh*, *Constance*, *Bellerophon*, *Vanguard*, *Caledonia*, *Albion*, *Queen*; again, page 267, the "deep draught" forward and aft given in feet and inches, contrasting the French and English practice of shipbuilding for ships of 120 guns down to ships of 16 guns; pages 321 to 326, constructors' mean "deep draught" of nine ships of the Royal West India Mail Packet Company; also, of 57 merchant steamers employed in various services; and of 30 vessels of the Peninsular and Oriental and East India Companies; page 327, constructor's "deep draught" forward and aft in feet and inches of 12 celebrated yachts; pages 405 to 410, constructors' mean depth from upper part of keel to the "deep draught" water-line in feet and decimals of a foot of 115 ships and 90 steam vessels of the French Navy; and, in like manner, the records of the Admiralty, if made public, would show the "deep draught" limit forward and aft in feet and inches, for which every ship and steamer in the Royal Navy of Great Britain was originally constructed.

Such being the recorded facts of the case, let it not be said that the ostensibly marking or "nailing," or otherwise delineating the constructors' deep draught limit on the stem, stern, and amidships of ships is an impracticable requirement. The general distance of such deep draught water-line below the main deck or other line of demarcation, according to the class of vessel, may be proportionally ascertained with reference to the breadth of beam of the vessel. What, therefore, is to prevent its being legally required and prescriptively determined that the constructor's or the regulation deep draught water-line shall be ostensibly marked or delineated, and that such water line shall, in no case, be less than one-fourth, or one-fifth, or one-sixth, or other specific proportion of the beam, as may be determined, below the main deck of such vessel? This point has been thus strongly urged and illustrated by reference to vessels of every class, because the *nailing* or otherwise ostensibly delineating the *deep draught water-line*, is the one essential requirement on which any legislation for registering the weight-tonnage of ships available for cargo, must be absolutely dependent.

Presuming, therefore, that such nailing or delineation of the regulation deep draught water-line on the stem, stern, and amidships of all sea-going vessels be determined upon and enforced, we may now proceed to consider what will be the required details of registration, and by what system of actual admeasurement or approximate computation these required details of registration will be practically most attainable. This division of the subject demands consultative deliberation; and it is for the purpose of aiding such deliberations by extending the range of choice of systems, and of means for attaining the desired object, that the following views are submitted for consideration:—

It is suggested that the registration of shipping embrace the following elements, namely:—

1st. The light draught displacement in *tons weight* (A) at the rate of 35 cubic feet of such displacement to the ton, being the weight of the ship itself completely equipped ready to receive cargo; also, the corresponding internal roomage (*a*) from the floor up to the light draught area, rated at 40 feet to the ton, such being the number of cubic feet conventionally allowed in commerce as the roomage measurement of freight per nominal ton.

2d. The displacement contained between the light and the constructors' or regulation load draught lines in *tons weight*, at the rate of 35 cubic feet of such displacement to the ton, being the capability of the ship for weight-cargo, to be called the weight tonnage for cargo (B); also, the corresponding internal roomage (*b*) as contained between the light and deep draught areas, rated as before at 40 feet per nominal ton.

3d. The external measurement from the load draught up to the deck, rated at 35 cubic feet to the ton, being the surplus buoyancy (C); also, the corresponding internal roomage (*c*) between the load draught area and the deck, rated as before at 40 feet per nominal ton.

4th. The light draught displacement (A) added to the weight tonnage for cargo (B), will give the deep draught displacement (D) in tons weight; being the gross tons weight propelled from place to place at such rate of speed as may be by the power employed, whether sail or steam, which is an element of essential importance in the formula $\left(\frac{V^3 \times D^{\frac{2}{3}}}{\text{Ind. HP.}}=X\right)$ whereby the *relative* locomotive merits of ships of different sizes and *different types* of build may be comparatively classed.

5th. The sum of the three quantities ($a + b + c$) will give the total internal roomage of the hull below deck; from which, deducting the roomage appropriated to engines and boilers, and adding the space between decks and other places available for cargo stowage, the result will be the roomage for cargo, or roomage tonnage (R) rated at 40 cubic feet to the ton.

The detail of measurement and calculations for determining the above integral elements will be hereinafter considered: for the present, it may be observed, that the above elements are, each of them, of commercial use: for example, as respects the light draught displacement in tons weight, although length, breadth, and depth from the keel up to the gunwale or main deck may be constituted as the functional dimensions for regulating the size of hull for which the builder is to be paid, still it will be generally satisfactory to the purchaser to know the absolute total weight of the material supplied, as given by the light draught displacement (A), not that such weight of material will, of itself, constitute a measure of the value of the ship, but a knowledge of such weight, conjointly with ocular inspection of the kind and quality of the material and workmanship, will materially demonstrate the substantiality of the construction of the ship, and afford a comparative indication of the money's worth received for the money paid. Nothing of the kind is afforded by the present registration record under the Merchant Shipping Law of 1854.

As regards the capability of the ship for weight cargo (B), the disappointment which constantly occurs from the nominal builders' tonnage of vessels being frequently called the "*burthen in tons*," which it is not, and erroneously regarded as the measure of the capability of a ship to carry tons weight of armament or other heavy cargo, is too notorious to need being dwelt upon; for example, see Fincham's "History of Naval Architecture," page 414, giving the builders' tonnage as the "*burthen in tons*," for all the ships of the British Navy built from the accession of Geo. I. down to the year 1850. Suffice it to say, that such mistakes and consequent miscalculations as to the capabilities of ships for mercantile transport service are commercially and nationally disastrous, and, perhaps, more than any other specific cause, conduce to mismanagement, disorganisation, pecuniary loss, and loss of life from the foundering of badly-stowed and overloaded ships. This element, viz., capability for weight cargo, is not noticed in the "Merchant Shipping Law of 1854."

As regards the internal roomage (R) available for *measurement* cargo, this element, taken *in conjunction* with the capability of the ship for *weight* cargo (B), is an important mercantile consideration, because the merchant will be able to assort his cargo in such manner that the ship shall be well filled as well as duly loaded, instead of being subject to the present irregularities of ships being sometimes deeply loaded before being filled, and at other times filled before being duly loaded. This cubical admeasurement of internal roomage is given by the Merchant Shipping Law of 1854, but it is given as an *isolated* element, without reference to the capability of the ship for *weight* cargo; and is, therefore, by itself useless for the purpose herein referred to.

As regards the deep or load-draught displacement (D), a knowledge of this element is essential to science as a means of investigating and determining the comparative locomotive merits of different types of build, and thence determining the comparative degree of £ *s.* *d.* economy which one type of build may possess over another under similar circumstances of transport service. This element is not embraced in the Merchant Shipping Law of 1854, and when the vast extent of commercial and national transport service of Great Britain is considered, conjointly with the superior transport economy of one type of build over another, as referred to in the paper read before this Society on the 16th May last, and more particularly set forth in Atherton's essay on "Steam-Ship Capability," 2nd edition, Table K., page 78, it cannot be doubted that this item of registration will at once bring science to bear on shipping affairs in a manner highly conducive to national interests, and from which affairs, by our present deficiencies of registration under the Merchant Shipping Bill of 1854, as amended in 1855, science is absolutely excluded from taking any prominent part. At present it is not by any recognised scientific test, but merely by opinion more or less confidently expressed, that any discrimination is made as to the relative merits of different types of form of ships, and more especially of steam-ships.

Such are the elements and objects of information which public registration undoubtedly ought to embrace. Registration ought to merit being popularly regarded as an institution working for the public good. But, on the contrary, our present registration of tonnage falsifies shipping statistics, and does not scientifically fulfil any useful object of tonnage registration other than that of being a network for the collection of imposts, and a net so defective even for that one purpose as to leave openings for all manner of evasion. Harbour dues, pilotage, and light dues are an admitted necessity in some shape or other, and registration ought not only to be a means of their equitable apportionment, but also, by aiding science, conduce to the most effective and economical carrying on of the trade from the earnings of which such imposts are to be paid.

We now come to consider the details of admeasurement for record, whereby the computation of the above-mentioned elements of registration may be determined. It is unquestionably desirable that each of the elements of registration should be correctly measured, but as the ordinary form or contour of ships does not admit of being mathematically defined, it follows that absolute mathematical precision of admeasurement by any precise formula or rule is defeated. In such cases, the well-known system called "Sterling's rule," of approximate admeasurement by ordinates, becomes usually resorted to. By this system, the more closely we desire that our admeasurement shall approximate to precision, the more numerous must be the ordinates, and the more lengthened will the operation become. For the purposes of scientific naval construction, this laborious routine of calculation is patiently performed by experienced hands. For ordinary purposes, however, of everyday life, nothing is more popularly repulsive or impracticable than long dogmatic rules for the working out of calculations of which the rationale is not understood by the generality of those concerned or employed to do the work. The consequence is, that such rules, however simple and correct in the hands of those who understand them, become repudiated for all ordinary purposes of mercantile calculation, and the old short rules, like the old tonnage law, which people have, from their youth, known by heart, and been accustomed to work by and to live by, notwithstanding that the constructive practice which originated these rules may have become obsolete, as in the case of shipping, continue, with all their errors, to be popularly acted upon and upheld.

The inveteracy of blind habit cannot be better illustrated than by the fact, that the old rule for calculating tonnage without reference either to depth of hold or draught of water, withstood the declared condemnation of several successive Parliamentary Commissions, and continued to be pertinaciously made use of to regulate ship-building contracts and the purchasing of ships in mercantile dealings, and even by government authorities, though legally superseded in 1834 by Act 5th and 6th William IV., c. 56; which thus, twenty years ago, prescribed and legalised a totally new system of tonnage admeasurement based on ordinates, as hereinbefore referred to, which system failed to be popularly adopted on account of its complication; but, nevertheless, a far more complicated extension of the same system has now been introduced by the Merchant Shipping Bill of 1854. It was not the want of accuracy that prevented the rules prescribed by the Tonnage Law of 1834 from being adopted, but the difficulty of opening up and popularising a royal road to mathematics even over the plainest ground. How then can it be expected that the more complicated extension of the same system, as legalised by the new Merchant Shipping Law of 1854 should be received. Popular education has, doubtless, of late years made great progress; but still we have scarcely arrived at such a state of proficiency as to render it advisable that our tonnage admeasurement, so constantly put in requisition by every merchant, should be the solution of the mathematical problem for the *reduction of parallelopipedons by rectangular co ordinates*. Were the new measurement of 1854 honestly called by this its proper name, it would not be listened to for one moment; the very name would expose it; but, instead of being thus designated, it is called Sterling's simple and easy system of admeasurement. Undoubtedly, Sterling's reduction of parallelopipedons by rectangular co-ordinates, like the calculation of eclipses, may be simple and easy to those who perfectly understand it, but a mystery to those who do not, and very likely to be bungled by those who attempt to apply it in ignorance of the principles involved. It being, moreover, now found by experience, that the new law of tonnage admeasurement is not generally and popularly applicable, and that the old and popular rule for calculating tonnage cannot be outrooted, unless some other rule, equally simple in its application and obviously intelligible, be substituted in its place, it may be well to examine whether, by doing away with the fundamental error of the old rule, namely, the substitution of half the breadth of beam for the depth, and thus taking cognisance of all the three dimensions, length, breadth, and depth, both externally and internally, we may be able to obtain data for satisfactorily calculating the elements before mentioned as necessary for useful registration. With this view, it is proposed that the following particulars and detail of ship's admeasurements be officially taken by authorised measurers and recorded in Tabular Form.

By the following scheme of detail dimensions, it is obviously intended to obtain the circumscribing cubical admeasurement, or product of length, breadth, and depth of different portions of the vessel taken separately; for instance, firstly, of that portion of the vessel, both externally (A) and internally (*a*) below the light draught water line area, secondly, of that portion of the vessel, both externally (B) and internally (*b*) which is contained between the light and the constructors' or regulation deep draught water line areas, and thirdly, of that portion of the vessel that is contained externally (C) and internally (*c*) between the deep draught area and the deck of the vessel. The cubical product of the circumscribing dimensions of length, breadth, and depth, being thus taken, both externally and internally for each of the three portions of the vessel, we shall be able to deduce approximately the contents of any new ship from the known proportional contents of ships of similar type of form with reference to their corresponding circumscribing dimensions of length, breadth, and depth.

TABLE OF DETAILS FOR RECORD.

______	Name of vessel.		
______	Year when launched.		
______	Year when measured for registration.		
______	Distance from keel to light draught.		Midship Depths.
______	Distance from light to deep draught.		
______	Distance from deep draught to deck.		
______	Length	At light draught	External Dimensions.
______	Breadth		
______	Length	At deep draught	
______	Breadth		
______	Length	At main deck	
______	Breadth		
______	Length	At light draught	Internal Dimensions.
______	Breadth		
______	Length	At deep draught	
______	Breadth		
______	Length	At main deck	
______	Breadth		
______	Distance from floor to light draught.		
______	Distance from floor to underside of deck.		
______	Length	Deductions from roomage of spaces not available for the use of passengers or stowage of cargo.	
______	Breadth		
______	Depth		
______	Length	Addition to roomage of covered in spaces above the main deck available for the use of passengers or stowage of cargo.	
______	Breadth		
______	Depth		
______	Engine power, with reference to some regulation unit.		
______	Total area of the fire-grates		
______	Character of the lines of the vessel—whether very full, full, medium, fine, or very fine.		

Thus, it is proposed that the lower portion of the ship, namely, the portion from the keel up to the light draught area, be, in the first place, approximately obtained by taking such proportion of its circumscribing product of length, breadth, and depth, as is known from experience to be the measure of bottoms of medium type of build, as respects the character of the fore and aft lines and the rise of floor, but again correcting this primary approximation by adding or subtracting a certain percentage, as the peculiar character of the lines of the ship to be measured may be comparatively full or hollow, and the floor comparatively flat or rising. For example, it is known that a ship must be very full, or what is called burthensome, for this lower portion of the bottom up to the light draught area to be 50-100ths of the circumscribing product of length, breadth, and depth, and that in a very fine bottomed ship, with unusually rising floor and hollow lines, it may be as little as 30-100ths; therefore, taking the mean of these extreme proportions, namely, 40-100ths of the circumscribing product of length, breadth, and depth as the approximate admeasurement of the ship up to the light draught area, the result will probably be within 10 per cent. of the correct measure, and the internal roomage up to the light draught area may be taken in the same manner, namely at 40-100ths of the circumscribing product of the internal length, breadth, and depth.

Again, it is known that the constructive form of a ship must be very full, carrying the body of the ship well forward and aft, if the light and deep draught areas of the vessel come up to 85-100ths of the circumscribing rectangular product of length and breadth, and that in a fine built ship it may be 65-100ths. In order, therefore, to obtain approximately the measure of that portion of the vessel which is contained between the light and deep draught areas, we may multiply the mean length of these areas by the mean midship breadth, take 75-100ths of the product for the area of the mean horizontal section between the light and deep draught lines, and multiply by the distance between the light and load draught lines; the result will probably be within 10 per cent. of the correct measure of this portion of the ship, between the light and load draught lines representing the displacement available for weight cargo; and the internal roomage between the light and the load draught areas may be taken in the same manner by taking 75-100ths of the product of the mean internal dimensions of length and breadth at the light and load draught lines multiplied by the distance between them.

Again, to measure the space between the deep draught area and the deck, multiply the mean length by the mean midship breadth; take, as before, 75-100ths of the product for the mean area, which multiply by the distance between the deep draught area and the deck, and the result will be within 10 per cent. of the correct measure of this portion of the ship both internally and externally. Thus, instead of our liability to error being absolutely unlimited, as is the case with the old rule of builders' measurement, in which no direct cognizance was taken of *depth*, we have now, by conventional approximation, reduced the limit of error down to 10 per cent.; and this extreme error may be again approximately corrected by some per centage, say 5 per cent., or 10 per cent. being added to or deducted from each of the foregoing results, according as the recorded character of the lines of the ship, may be full or very full, hollow or very hollow, as compared with lines of medium character, on which the foregoing approximate results have been based. By this arbitrary correction of the primary approximation, based on the character of the lines, it is probable that the result of the computation would be within 2½ per cent. of that which would be obtained by the system of admeasurement by ordinates; such as that originally legalised in 1834; and subsequently rendered more elaborate by the Merchant Shipping Bill of 1854, now in force. It is acknowledged that these proposed rules, based on the actual admeasurement of the circumscribing product of length, breadth, and depth, corrected in the first place by conventional approximation to the general medium form of ships; and, secondly, again corrected by reference to the peculiar character of the lines of the ship to be measured, do not present a purely scientific system of admeasurement; they give merely an arbitrary approximation, the result being probably within 2½ per cent. of actual precision, and, therefore, practically answering the intended purpose; but, nevertheless, the detail of admeasurements for this proposed system, being merely the length and midship breadth at the light draught and at the deep draught, and at the deck, and the respective depths between those areas, are so analogous to the admeasurement under the old rule of builders measurement, that it is conceived there will be no difficulty in filling up the tabular record of data as given in the foregoing form, and thence working out the results of light draught displacement (A), weight tonnage for cargo (B), internal roomage (R), and regulation deep draught displacement (D), of any ship; each and all of which results are indispensable for rendering the registration of shipping a legislative protection over property and life, a record of mercantile value in connection with the conveyance of cargo, and enabling science to give its aid in estimating, from the actual performance of ships, the relative degrees of merit between ships of different types, and thus promoting £ s. d. economy in the commercial transport service of Great Britain, amounting, it is said, to about twelve millions of tons weight per annum. It is also to be observed that the details of admeasurement hereby proposed do not embrace the objectionable and inquisitorial system of taking off the builders' lines of a ship as is done by the admeasurements under the Merchant Shipping Law of 1854. The objection as to taking off the builders' lines may also be urged on the part of builders against any system for correctly taking off the horizontal areas or sections, and also against the system of measurement by means of a curve of vertical sections, which system is understood to have been originally suggested, and practically applied in the year 1829 by Mr. James Peake, a shipwright officer in her Majesty's service, and is certainly a system readily applied, and capable of giving even more correct results than are obtained by Sterling's rule; but though admirably adapted for prosecuting the calculations of a ship constructor, it may not be conveniently available for ordinary use, as it involves the necessity of laying down lines to a scale, which art, though easily acquired, is not commonly understood. In fact, Mr. Peake's system of aggregating the measurements by means of a curve of sections, is said to be the system now adopted for verifying the results of the admeasurements taken under the Merchant Shipping Bill of 1854.

We now come to consider what dimensions, or combination of dimensions, may best constitute the builders' measurement, in lieu of the old law, still in use, though legally repealed since 1834. In the first place, as the capability of the ship for weight cargo (B) has not any definite or constant ratio to the gross size of the ship for which the builder must be paid, it cannot be taken as a measure of the builders' tonnage, nor would the size of the ship be fairly represented by the internal roomage ($a + b + c$) irrespective of external dimensions. Strictly, the light load displacement, giving the actual weight of the ship, is the most correct integral indication of quantity of material delivered under the builders' contract. Ships, like marine boilers, may, if so agreed upon, be built by the ton *weight*, the price per ton weight varying according to specification of materials and workmanship; but, in fact, though ships were to be paid for by weight, it would still, as in the case of boilers, be requisite that some determinate *size* be stipulated for as the base of the contract, to be called, according to custom, the "builders' measurement." The true measure of this quantity would be the external bulk of the ship, less the internal capacity; but a rule based on these elements would not answer a merchant's purpose as conveying any idea of the size of the ship to be built. It is, therefore, submitted that the builders' measurement be determined by taking the product of the external length and breadth as measured at the regulation deep draught water line multiplied by the internal depth of hold, and divided by 100. This result to be corrected as before stated (if so thought necessary) according as the intended ship may be proposed to be built with full lines burthensome for cargo, or finer lines more adapted for speed. This proposed rule for determining what may be called the "Builders' Measurement," is almost identical with the French rule for determining tonnage. It is also to be observed that this rule embraces the two dimensions, length and breadth, whereby alone the builders' tonnage has hitherto been calculated by the old law, and it also embraces the *depth of hold* whereby, conjointly with external length and breadth, merchants are accustomed to form an idea of the size of ships. It is also suggested that this Builders' measurement be registered and continued as indicating the size of the ship on which harbour dues, pilotage, light dues, and the like are to be assessed.

Finally, the question remains whether or not, in charging harbour dues, pilotage, and the like, any allowance be made in the case of steam-ships for the space taken up by the machinery and not available for cargo. In considering this question, it may be important to bear in mind that the imposts in question are charges necessarily made in consideration of *accommodation* or *services* actually rendered, and which are greater or less according to the gross size of the ship, and are entirely irrespective of the kind, quality, or value of the cargo which the ship may hold. If, however, the roomage for cargo is to be made the subject of discrimination between sailing ships and steamers, as was originally enforced by the law of 1819, and continued by the new merchant shipping law of 1854, why should not the *value* of the cargo be taken into account for assessing these imposts as well as the mere bulk thereof. Should this be done, it is probable that the average *value* of the cargo of steam-ships, though small in quantity with reference to their gross tonnage, would be found as great as the *value* of the cargo of sailing vessels, though large in quantity with reference to their gross tonnage. But, further, this Merchant Shipping Bill of 1854, notwithstanding the amendment thereof of 1855, curiously shows the endless task of legislative discriminations; for example, by clause 23 (*a*) one scale of tonnage deduction is prescribed for vessels propelled by paddle-wheels, and another scale of deduction for vessels propelled by the screw, but no provision has been made for the paddle-wheel and the screw being both combined in the same ship, as in the great leviathan now in progress of construction for the Eastern Steam Navigation Company; nor, on the other hand, has any provision been made for the case in which the mode of propulsion is neither the paddle nor the screw, as in the North Fishery steam-vessel *Enterprise*, which is propelled by a jet. It may be observed, that the benefits incidental to steam navigation ought to meet the disadvantages which may be incidental to that system, without reference to discriminating systems of tonnage admeasurement, favouring one system of shipping to the disadvantage of another. This remnant of pampering protection is surely injurious to the health of commerce, and though consonant with the spirit of the times in 1819, when this discrimination between steaming and sailing originated, it is not consonant with the principles of commerce now adopted in 1856. These, however, are mercantile, rather than professional considerations.

It is, therefore, submitted for the consideration of the Society of Arts that the official survey of shipping should embrace the various details herein-before referred to and specified in tabular form; also, that port records be taken of the draught of water at which all ships leave PORT, showing the deficiency or excess as compared with the regulation deep draught line; and that the officially published records of shipping registration, such for example as that in the merchant navy list, shall embrace the following points: 1st. The *Builders' Measurement*; 2d. The displacement in tons weight available for cargo, or the *cargo tonnage*; 3d. The nett roomage available for cargo, or the *cargo roomage*; 4th. The deep draught *displacement* of the ship, calculated to the regulation deep draught line; and 5th. The horse-power of steamers calculated with reference to some definite and legalised unit, and to be called the "Marine Horse Power." It is submitted that such registration would fulfil the requirements of public good, of commerce, and of science; and, in respect to humanity, the prevention of a wreck being better than the saving of a crew, it is submitted, without disparagement of life boats, that the most effectual of all institutions for the protection of life and property from shipwreck, would be *effective* REGISTRATION.

DISCUSSION.

Mr. MOORSOM (Inspector-General for Tonnage to the Board of Customs), in a note to the Secretary, says his "official duties are so onerous at the present time, besides a great infirmity of hearing, as to entirely preclude him from turning his attention to scientific colloquial discussions." He, however, observes, "that the burden of Mr. Atherton's condemnatory harangue of the existing law of measurement, is on the absence of its having expressed the dead-weight which a ship is enabled to carry. Now, shipbuilders, shipowners, and the highest authorities connected with maritime affairs have set little value on this, Mr. Atherton's desideratum, so long as the true internal cubical capacity is made the basis of the fiscal law. This latter has been faithfully effected, as avowed by Mr. Atherton himself, though in the more concentrated form of 100 feet to the ton, instead of 40 feet to the ton, which Mr. Atherton would have preferred. It is, however, intended to reduce it to the 40 feet, and show it on the ship's register, for the purpose of greater commercial convenience, retaining at the same time all the present advantages (which are many) of the existing legal standard for the assessment of light and other dues. And as regards the dead-weight a ship is enabled to carry, which is also contemplated to be placed on the register, it can be ascertained as correctly, if not more so, from the present cubical tonnage, as it possibly can be from Mr. Atherton's empirical load and light floatations, the positions of which the highest and most intelligent authorities in this country have pronounced as impossible of satisfactory attainment. I have, therefore, only further to observe that, as the dead-weight proper to be carried by a ship is confessedly, on the part of Mr. Atherton, "the sum, substance, and essence of the whole system of reform in tonnage registration" he seeks for, and as it is attainable on quite as legitimate grounds by the legal means at hand as by further legislative enactment, the present agitation against the law, before even its first operations can be fairly judged of, is, I submit to the judgment of all liberal minded men, an unnecessary and premature proceeding. In conclusion, in order that the system may not appear so abortive as pronounced by Mr. Atherton, I have to state that already, in the first eight months of its operation, above 2,000 ships have been *re*-measured under it by their owners' application; and further, beg to add the following testimony of Mr. Gilmour, who is the owner of 30,000 tons of shipping—the largest private ship-owner in the world—and of Messrs. W. S. Lindsay and Co., owners of 20,000 tons, and second only as private ship-owners in importance to Mr. Gilmour. Mr. Gilmour's testimony is contained in a letter of the 4th instant, written on the occasion of his being informed that a party had publicly stated he, Mr. Gilmour, had condemned the new system. Mr. Gilmour says, 'I am exceedingly astonished at Mr. ——'s conduct. I told him candidly I could not approve of his mixed mode of measurement, and that the mode of measurement now in use was as true and as perfect as could possibly be, and that I had no doubt it would remain the law of the land for many generations; that I had not met *one* man who has a word to say against the mode of measurement, but all those not interested in steamers complain bitterly of the allowance for the engine-room, and even some of the steam-boat owners admit it is too much.' Messrs. W. S. Lindsay and Co., in their circular list of freights, dated Jan. 1st, 1856, say:—'The new law of tonnage admeasurement, which came into operation on the 1st of May last, appears to have fully realised the anticipations of all who were favourable to its introduction. We have before us the register tonnage of 1,100 ships, measured since that date, under the new Act, and their register tonnage under the late Act, and considering that the principle of admeasurement was entirely changed, it is remarkable that the difference in the measurements is so small. These 1,100 ships under the late law, measured 248,842 tons, and under the present Act they measure 231,277 tons, showing only a difference of 7 per cent. (decrease) between the new and late law. The principle of the new law is to take the cubical contents of the ship's hold, and all enclosed spaces for cargo and passengers, and upon that base the register tonnage, so that ship-owners can now build vessels of any models they please, without being subjected to an extra tax, as they were in many cases under the late law, when they constructed vessels of the most approved forms for speed and safety. That the new law will answer all the objects its promoters had in view, there cannot now be a doubt. The accuracy, too, with which vessels are measured under it, and the check upon error or fraud in the admeasurements are worthy of notice. Competition with other countries has done much, very much of late, to improve the model and mode of construction of British ships, and this new law leaving owners as it does, free to construct their vessels on the most approved lines, is aiding in a remarkable manner the rapid progress (commencing with the repeal of our Navigation Laws) which these vessels have made of late years. The contrast between the vessels recently built and those launched only five years ago is indeed striking.' "

The **Chairman** said, as two such high authorities as Mr. Gilmour and Messrs. Lindsay and Co. had been quoted in favour of the existing law of registration, it was highly desirable to have some remarks from gentlemen connected with the shipping interest; and, as he saw Mr. Scott Russell present, who was both a shipbuilder and shipowner, he would request him to make a few remarks.

Mr. **Scott Russell** said, before he made any observations on the subject, he would ask Mr. Atherton what his idea was as to the possibility of finding a loadwater line, and as to the means which appeared to be within reach for determining it.

Mr. **Atherton** would suggest that some limitation should be prescribed—for instance, supposing a ship to have a thirty feet beam, then the deep-draught water-line might be fixed at a certain proportion of the beam—say a fourth, a fifth, or a sixth, below the main deck. This, however, would be a matter for serious consultative deliberation, but something on that principle was what he would suggest—and, as in Mr. Fincham's "Treatise on Naval Architecture," the deep draught water-line of some thousands of ships was given, that would be a useful book of reference to see the general averages.

Mr. **Scott Russell** quite agreed that there existed an immersion of ships, beyond which any further loading became dangerous, and, therefore, that it was desirable to fix what that illegal over-loading was. The gunwale of a ship might be allowed to come within either a fixed dimension in feet from the water, or a given proportion of the beam from the water. With reference to the proposal of Mr. Atherton that a much fuller return should be furnished in regard to every new ship, he agreed with him in thinking that such a course was most desirable, and it could not be objected to on the part of shipowners. All the additional particulars enumerated by Mr. Atherton should be obtained by government, and should, in some shape or other, be placed at the disposal of the public, and he apprehended that the present board of measurement at the Customs would be very willing to avail themselves of the organisation which exists in order to carry out that object. In regard to the suggestion for the registration of the light water draught of every vessel, or, he might say, the light displacement, it was a very practical one, because the vessel on leaving the builder's yard might have on board a full equipment, and then her displacements and draughts of water at both ends might be easily and usefully registered. That would form, in some degree, a registry of the money spent on the ship, but not of the value of the ship, or her quality. In iron ships it would not show the advantageous disposition of the materials as regards strength. As a shipbuilder, and shipowner, he should not have the least objection that both these should be required. He then came to the next point, which was an essential one. If they granted that there should be a load water-line and a light water-line, and a light water displacement when the vessel was delivered over to the owner by the builder with a clean-swept hold—then Mr. Atherton had got all he wanted, because if they then took the measure of the displacement of the ship when full, by calculation, and if they had her displacement when she had merely her own weight to carry, the difference between those two was actually the load tonnage capacity of the ship which Mr. Atherton wanted to obtain, and that would show exactly the number of tons of dead weight, independent of roomage, thus giving a really absolute measurement of the total tons of dead weight a ship would carry. He considered it most desirable, both for shipbuilders and shipowners, to know the exact tonnage capacity of a ship. There was one thing which he objected to in a financial point of view—namely, the altering the registered tonnage of a ship in any way—that is to say, the bringing down the 100 cubic feet by which the nominal tonnage was now divided to 40 feet, because they could not control the fiscal regulations of other countries. If in this country they were to adopt a system of real dead weight tonnage, or anything more approaching to the truth than the fiction on which they now charged register tonnage, they would immediately put a very heavy tax upon the shipowner. At present they, in this country, were as honest as they could afford to be; and, if they did not get other countries to adopt a similar system, they would have to resort to what Mr. Moorsom said in his letter—namely, to have two tonnages written upon their ships.

Mr. **Atherton** said, it would be observed in the paper that he proposed the builders' measurement should continue as at present, and be determined according to the French mode. When he alluded to the registration of what a ship would carry, and also the roomage, that was merely additional information to be placed on the records of the Board of Trade for the information of the public.

Mr. **Scott Russell** entirely agreed in the desirability of having the roomage tonnage registered, as also the absolute dead-weight tonnage. What, then, should be stamped upon the ship herself, in relation to ships of other countries, had better remain a matter of mere fiscal regulation. He had no objection to the register tonnage being taken arbitrarily from the length and breadth—the depth of the hold being taken as an element. As far as the buying and selling of ships, the plan proposed, or something like it, would be an advantage, and a more honest plan, perhaps, than the present. He thought that shipowners, in buying ships, were continually deceived; they bought a ship which they were told was so many hundred tons, and a second explanation had to be made. He had for many years gone on the opposite principle—that of building ships for his customers merely with reference to what they would carry and what they would cost. He found it much better for both parties—it prevented misunderstandings; the builder gave his customer exactly what he wanted; the real interest of the customer was promoted; and, as a necessary consequence, in the long run, the interests of the builder himself. His plan was, instead of the usual plan of building by register tonnage, to ascertain the number of tons of goods required to be carried; the room required for light cargo, and the number of knots per hour which the vessel should be able to sail; and, having done this, he proceeded to calculate and settle the price at which a ship could be built to perform the necessary conditions, in a good and seaworthy manner. According to his experience, this plan had worked well, and was beneficial to both shipowners and shipbuilders. He was not sure that the present mode of measurement was not a very fair one, for fiscal purposes. He, to a certain extent, took the side of Mr. Moorsom on the subject—he thought that the measurement of Mr. Moorsom had been planned with a view to obtain some of the advantages they had all along been contending for, namely, allowing the builder a tolerable latitude in the shape of his ship, without injuring him in reference to the fiscal charges of the vessel, which to a certain point was still done; therefore, he would say, better let the nominal fiscal tonnage remain as it is, and add to it all the information proposed to be obtained by Mr. Atherton, than be immediately changing it again for certain minor advantages. As far as he had seen of the present law of tonnage it worked tolerably well, and adjusted the fiscal taxation to the average earning power of the ship. In conclusion he would observe, that the addition of all the information asked for by Mr. Atherton, would be a great boon to the shipbuilding and shipowning public, and that it would be of great advantage if the existing organization for the measurement of tonnage were used for obtaining the additional information, and he did not think government interference would be more acceptable in anything connected with mercantile interests than when it was used for the purpose of obtaining correct statistical information.

Mr. **Pearsall** inquired whether there was not an essential difference between the buoyancy of deep sea-water, and the water of our rivers, so much so, indeed, as to allow a ship to sink materially when she came into the latter, and thus have a tendency to endanger the ship.

Mr. Scott Russell stated that the difference existed but to a comparatively small extent. The difference between the floatation of a very large ship, indeed in salt and fresh water, would not amount to six inches.

Mr. Atherton said, the deep draught water line might always have reference to sea-water.

Mr. Andrew Henderson concurred in the views so ably expressed by Mr. Atherton. He had listened with much interest to the historical sketch of the progress of tonnage measurement, and the lucid explanation of his views given by Mr. Scott Russell, the fair reasoning and practical application of which contrasted most favourably with the tone of Mr. Moorsom's letter just read, in which, while again declining scientific discussion, he designated his opponent's views as a "condemnatory harangue" and an agitation against the law. Mr. Atherton had rightly observed that the question now raised was one of PRINCIPLE, as to whether the internal space or roomage of vessels was to be the basis of all public record of the capabilities for payment of fiscal dues, or whether tonnage registration was to comprise an external or displacement measurement defining the weight of cargo capable of being carried with safety, as well as information of commercial utility and locomotive capability. His own opinion was, that by carefully investigating the advantages of both modes of measurement, they might be combined; but, unfortunately, there was much difference of opinion both as to the mode and principle of measurement, as well as to the object of registration. He would remind the Society that at their meeting on the 16th of May last, Mr. Scott Russell explained the anomalies that had arisen by the then new mode of measurement under the Merchant Shipping Act of 1854. He (Mr. Henderson) having visited Liverpool, the Clyde, and other ports, found a very strong feeling against the reduction allowed to steamers in the register of their tonnage as compared with sailing ships. Knowing this, he was not a little surprised to find that Messrs. W. S. Lindsay and Co., in their circular of the 1st of January last, stated that "The new law of tonnage admeasurement, which came into operation on the 1st May last, appears to have fully realised the anticipations of all who were favourable to its introduction;" and that the register tonnage of 1,100 ships, measured since that date, under the new act, and their register tonnage under the late act, showed so small a difference, as only 7 per cent. decrease—which, considering the principle of admeasurement was entirely changed, was remarkable. He alluded to the statements in this circular as showing one of the difficulties in the way of reform in such matters, for the statements were erroneous in all points except as to the amount of reduction of 7 per cent. in the general tonnage, for, so far from the principle being entirely changed, the new act was based on the internal measurement that had been in operation since 1834, while in principle, the old, or builders' tonnage, was an external measurement. The first Committee of 1821 reported in favour of a change to internal measurement. This was not carried out. However, the proposal, along with nine others, was brought before the Tonnage Committee of 1833. Of the nine propositions, three were for internal measurement, viz.; those by Mr. Palmer, Mr. Riddle and Lieut. Raper; and six proposed external measurement, including those by Messrs. Hookey, Carter, and Davis Gilbert. Mr. Wood, of Port Glasgow, suggested the measurement of eight sections, by which he had built and sold ships. Mr. Parsons, a naval architect, proposed a rule for the displacement-measuring of the hull as the basis of tonnage, the computation being facilitated by the use of diagrams, sections, and curves of areas, as recommended by Mr. Peake. The Committee reported in favour of the internal measurement, as adopted in the Act of 1834, and subsequently modified. The Commission of 1849 was appointed to inquire "into the defects of measuring ships for tonnage and to frame a more perfect rule." The Commission comprised Lord John Hay and two nautical gentlemen, the representatives of shipowners, insurers, shipbuilders, and five surveyors and naval architects. It reported that the equitable basis on which charges and dues should be made, was the entire cubic contents measured externally. It framed two rules, which were embodied in the Bill of 1850. A proposition was then made by Mr. Moorsom to substitute, for the principle agreed upon by the commission, an internal measurement differing but in name from that which had been found imperfect since 1834. After some delay, this became law in 1854, and came into operation on the 1st of May, 1855. In other words, the principle was abandoned, on the assumption that the difficulty in the detail effecting the measurements were insuperable. The working of the new act he found to be as follows:—That the whole establishment was a branch of the Custom-house, having a surveyor-general of tonnage in London, and a surveyor at one outport. He had ascertained, from inquiries at the outports, that the Custom-house measurers found great difficulty in obtaining a correct mensuration in the tabular formula to be forwarded to the surveyor-general. From this copy, furnished by the builder, it would be seen that the rule prescribed that the sections should be taken at exactly equal distances of the length, and the measured breadths at four or six exactly equal distances of the depth of hold to the decimal part of an inch, these intervals being used as the multiple for computing the cubic contents of hold and tonnage. Any error in the height or distances measured must render inaccurate the whole calculation, while the fixtures in the hold of ships and steamers, of masts, engines, &c., rendered it often impossible to take the measurements at the proper places. This difficulty had led some of the measurers to form diagrams of the sections by a curve run through the measured breadths; this at once showed erroneous ones, which could be remeasured and corrected before the tonnage was calculated, and thus prevent a wrong registration. Instead of this the new rules oblige the measurers at every port in the kingdom to send a copy of this printed formula to Mr. Moorsom, the registrar-general at the Custom-house, London, where it was stated he could form *detective curves* to ascertain if any attempt had been made to *evade the fiscal dues* by incorrect measurement. If error was discovered in London, it became necessary to send to the distant port for correction, and. should the ship have sailed in the meantime, it rendered her remeasurement on return necessary, which delay and expense would have been prevented if the diagrams and curves had been formed at the time of measurement by the local surveyor and the builder or owner.

Mr. Mitchell said, without entering into the merits of the two modes of admeasurement so ably set forth by Mr. Atherton, and so clearly explained by Mr. Scott Russell, there were one or two statements made use of by Mr. Atherton, to illustrate what he considered to be the evils of the present system of tonnage admeasurement, which, he thought, required notice, because they appeared to him to be unjust towards the legislature as well as the British shipowner, and not sufficiently exact to go forth to the public as admitted facts. Mr. Atherton alleged that, whilst every care was taken by the legislature to guard against accidents and loss of life on railways, by strict supervision on the part of the government, no notice whatever was taken of the loss of life at sea by reason of the unseaworthiness of ships, through being over-loaded or otherwise. Now it should be known to the public that, in the Merchant Shipping Act of 1854, which had been so frequently referred to by Mr. Atherton in his able paper, there were stringent provisions in regard to the seaworthiness of ships, and very heavy penalties were inflicted on the shipowner, in the event of loss of life at sea through unseaworthiness, from whatever cause it might arise. He thought, therefore, that it was proper the public should know that they were thus cared for and protected when travelling in British ships, as well as they were by that supervision on railways so warmly commended by Mr. Atherton. There was another point referred to by Mr. Atherton which, in justice to the shipowner, was also deserving of notice. It was inferred in one part of the paper read that night, that British shipowners were interested in the present mode of admeasurement, because it was difficult to comprehend, and deceptive, and that in fact they were opposed to any further legislation on the subject from fear of exposing the "mysteries of their craft." But if the system advocated by Mr. Atherton could be introduced, the public, we were told, (but in what way he was at a loss to discover) might fairly calculate upon a reduction of the present "rate of income tax and the price of bread." He feared, however, that if we were induced to expect to effect these desirable objects by an alteration in the mode of admeasurement of our ships, we should greatly deceive ourselves. But in this case also the public were sufficiently cared for and protected by the legislature, because, if they were liable to imposition by the present mode of measuring British ships (which he could not believe), they were at perfect liberty, since the repeal of the navigation laws, to employ foreign ships, which were not subject to this alleged objectionable admeasurement. He mentioned this fact to show that there was no law to enforce the employment of British ships, which were said to be so improperly represented to the public—through the "mysteries of the craft"—in the present mode of admeasurement; but he did not think that our merchants and travellers by sea availed themselves of this option to an extent that would tend to justify the charge of deception brought against British shipowners by Mr. Atherton; hence the statement of Mr. Atherton, in this respect, appeared to him not only inapplicable but without foundation in fact. He had felt it his duty to make these observations, in order that the public might not be misinformed on matters of such vital importance, and that the British shipowner might be fairly represented in connection with the interesting subject so ably treated by Mr. Atherton.

Mr. Atherton replied that, although the Mercantile Shipping Act of 1854 had imposed penalties in cases of proved neglect in shipwreck, it had done nothing to prevent the causes of shipwreck. Mr. Mitchell had misapprehended the drift of his arguments in reference to the proceedings of the shipping interests. He (Mr. Atherton) argued that if science were brought to bear, as it ought to be, and would be by the aid of effective registration, on shipping construction, the result would be an improved type of build, highly conducive to economy in the conveyance of goods.

Sir John Rennie said the Society was greatly indebted to Mr. Atherton for bringing forward such an important subject as the one which had been under consideration that evening. When they came to consider what a contrariety of opinions there were as to the mode of ascertaining what the capacity of a ship really was, they would agree that it was a source of great discredit to this country. In conclusion, he had much pleasure in moving a vote of thanks to Mr. Atherton for his able paper.

The Chairman said every member of the Society would join in cordially thanking Mr. Atherton for his paper, from which they would gather that what he proposed would be an additional security to navigation, and be of immense benefit to this country generally. They learnt from the observations which had been made, that by registering the load water line and the light draught line, they would have the means of ascertaining the amount of tonnage which was available either for dead weight, as sailors would term it, or for cargoes the specific gravity of which was lighter than water. Great results would follow if the suggestions of Mr. Atherton were adopted, and he had much pleasure therefore in putting the vote of thanks.

Mr. Atherton said, that it was gratifying to him that the paper which he had been permitted to read that evening had produced the effect of eliciting from gentlemen eminently qualified to judge of the national importance of statistical shipping registration, the expression of their opinions as to the necessity for the introduction of an improved system of tonnage registration, and of their views as to the practical proceedings most likely to conduce to the attainment of the desired object. The British Association, impressed with the desirableness of inquiry into the subject of tonnage registration, had appointed a committee for this purpose, and one of the objects with which he had brought this question before the Society of Arts, had been to submit for public review an exposition of the *technicalities* of the subject, elicit the opinions of others, and thus become instrumental in collecting information and setting forth a statement of the case that might assist the committee of the Association in the prosecution of their labours, and perhaps be deemed worthy of consideration, even in official quarters, whence legislation in all proved cases of the requirements of public good might be expected to emanate. The opening up and expansion of this question, not its restriction to his own or to any other particular set of views, had been his object on the present occasion. He therefore thanked the gentlemen who, in responding to this call, had thrown additional light on the subject by the expositions which they had that evening announced; and in concluding this discussion he begged to nail upon the mast, under which we were sailing in the loyal prosecution of this good cause, the declaration that tonnage registration, the base of maritime discipline, ought not to continue, as it now was, a delusion as to the mercantile statistics of the country, not affording data for meeting the requirements of commerce, or of science, or of humanity, but it ought to be a statistical record of fact, affording official data valuable to commerce, instructive to science, and promotive of humanity;—valuable to commerce as enabling merchants, and if need be, the government, to apportion the amount and kind of shipping to the amount and kind of their transport requirements;—instructive to science, as aiding its devotees in their patriotic labour of discriminating, on scientific principles, what types of form in ship-building are most conducive to locomotive efficiency, resulting in economy of goods conveyance; and promotive of humanity, as affording the means of investigating the causes under which in the course of a single year no less than 1,799 vessels have been wrecked at sea, as appeared by the *Shipping Gazette* to have been the case during the past year of 1855, and preventing the recurrence of such causes for the future. He begged to express his thanks to the meeting and to the chairman for their favourable reception of the paper, by which he had thus endeavoured to bring the question of tonnage registration before the notice of the Society of Arts and of the public.

On the motion of Mr. Henderson, seconded by Sir John Rennie, a vote of thanks was passed to the chairman, which having been acknowledged,

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 23rd inst., was "On the Manufactures of Price's Patent Candle Company," by Mr. G. F. Wilson, F.R.S. On this evening Dr. Lyon Playfair, C.B., F.R.S., will preside.

EIGHTH ANNUAL EXHIBITION OF INVENTIONS.

The following circular has just been issued to all patentees and others:—

Society for the Encouragement of Arts, Manufactures,
and Commerce, Adelphi, London, Jan. 17, 1856.

Sir,—In the year 1847, the then Council of this Society felt that, in the absence of a permanent Museum of

Inventions, it would be beneficial to collect annually for public examination, for a limited period, as many specimens, models, drawings, and descriptions of recent inventions, whether patented, registered or not, as it was possible to obtain the loan of. Succeeding councils have taken the same view; and I am desired to inform you that it is intended to open the Eighth Annual Exhibition of Inventions on EASTER Monday, the 24th of March next.

If you propose being a contributor, it is necessary that you should *communicate with me forthwith*, stating, 1st. The title of your invention. 2nd. Whether the article to be exhibited will be a specimen, model, or drawing.

The articles must be forwarded to the house of the Society *carriage paid*. The days fixed for their reception are Thursday the 6th, Friday the 7th, and Saturday the 8th of March.

All articles should be accompanied with a brief description of the invention, a wood-block (where possible), and a reference to any publication where a fuller account may be found. I enclose for your guidance a specimen page from the last catalogue.

I beg to add that no charge whatever is made for space, and that the Exhibition is open free.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

LOCAL SUB-UNIONS.

Mr. John Banks, the Honorary Secretary to the Hastings Mechanics' Institution, writing in a local paper in reference to the proposed meeting, on the 18th instant, of representatives of the metropolitan and other Institutions, says:—

"It may be asked, 'How is it, if annual conferences are held, that this meeting is deemed necessary?' 'How comes it that, though the Union has existed now between three and four years, so little practical effect has resulted as to require an extra meeting for the consideration of the very subjects which have formed part of the agendas at the various conferences?' I believe the fault lies with the Institutions themselves. I will leave the subject of classes for a future communication, and will confine myself, in this letter, to lectures. I have attended every conference hitherto, as the representative of the Hastings Mechanics' Institution, and it has always struck me that, for the lecture department to be improved by means of the Union, Institutions must exert themselves much more than they have hitherto done for that purpose. The Society has annually published a List of Lecturers, recommended by different Institutions, and this list has been circulated extensively among the Institutions in Union, but I question very much if any practical good has resulted therefrom—and simply for this reason, no combination exists among local Institutions for the purpose of giving effect to the lecture department. One Institution may probably engage a recommended lecturer from a distance, but the lecturer, coming, perhaps, from London for a single engagement, comes at his maximum charge, and, of course, the funds of the Institution suffer in consequence. Local unions are wanted, and then, doubtless, first-rate lecturers might be obtained at a reasonable rate. This South-Eastern corner of England (Kent and Sussex) is admirably situated for the purpose of carrying out such an arrangement. There are Institutions at Tunbridge Wells, Margate, Dover, Folkestone, Ashford, Canterbury, Maidstone, Rye, Hastings, St. Leonards, Battle, Hailsham, Eastbourne, Newhaven, Lewes, Brighton, Worthing, Chichester, Horsham, and East Grinstead—all connected with London and each other by railway, and most of them, if I mistake not, belong to the Union. What is to hinder these Institutions, or some of them, combining for the purpose of obtaining lectures at a reasonable rate? Nothing, but local wants and local prejudices. Hastings wants science, it may be; Rye, readings from Dickens or Shakspeare; Battle, lectures on light literature; Maidstone, on music; St. Leonards, on poetry, and so on. But I cannot help thinking that, if we would consent to eschew, to some extent, local predilections, a combination might be formed in this part of England—certainly second to none in the means of mental improvement, in which this town is said to be so lamentably deficient. I do not, by any means, admit this latter assertion, though I do think that Mechanics' and other associated Institutions have it in their power to improve very materially their position, and to increase their usefulness, by a local union such as I have alluded to."

Home Correspondence.

SILK-WORM FISHING GUT.

SIR,—In reply to Mr. Wells, I beg to state on this subject that the precise time for immersing the silk-worm caterpillar in vinegar, is when it has left off feeding, and is looking out for a convenient corner to spin his cocoon.

The silk bag is then perfected, out of which the gut is produced by maceration in strong vinegar. The time for maceration is about three weeks, or more if the weather should be cold and unfavourable. When near the time one or two of the worms are taken out and tried.

After due maceration the worm is broken exactly across the silk bag, and the two parts are drawn gently asunder until the gut appears to be of the proper thickness, and then hung up to dry in the air.

In regard to the vinegar, I hardly know what to say, for in England everything is what it is not. English vinegar is either a chemical compound, with a base of pyroligneous acid, or a villanous compo of sugar and water, spoilt beer, and vitriol.

That used by the Italians is true vinegar, made by the following process:—The husks and stalks of the grapes, after the wine is pressed out, are set by to undergo the acetous fermentation for about three weeks, when they are again submitted to the press, in order to draw off the vinegar, which is perfectly clear and very strong.

HENRY W. REVELEY.

Parkstone, Poole, Dorset, January 12th, 1856.

QUANTITY *VERSUS* QUALITY.

SIR.—The result of the proceedings of our iron masters for the last forty years of peace becomes painfully evident when we pass into the state of war. We have not a piece of ordnance, of any size, that can compete for strength with those of our enemy;—many ineffectual attempts have been made both in the Crimea and at home to burst a Russian gun, and it has been found impossible.

However skilfully scientific men may plan, owing to the wretched stuff of which it is cast, an English gun is quite as likely to explode at the breech as to propel the shot from the muzzle—nor have we been left without some indications of what was to happen; witness the number of cast-iron girders which have broken down of late years without any apparent fault, a disaster that involves the destruction of a certain amount of property and loss of life; but in warfare the bursting of a few guns and mortars may cause the loss of a year, thousands of lives, and millions of money to the nation.

We must no longer allow ironmongers' cast-iron to be used for artillery, and we must establish a better and more scientific mode of casting. It is not sufficient to run the mould full with the liquid metal; there must be a pressure-head of ample weight to force the crystals of the setting metal into close and intimate union. The power of crystallisation is immense, and to compel the union in such a casting as the mortar for the 36-inch shell, there should be a pressure-column of at least 15 feet above the mould. With such powerful hydrostatic pressure, even with our present degraded metal, we should hear no more of breaking girders or of bursting guns and mortars.

A CIVIL ENGINEER.

Proceedings of Institutions.

Bexley Heath.—A *soirée* and exhibition, which were recently held in connection with the Society for the Promotion of Useful Knowledge, are said to have much benefitted the financial affairs of the Society. The exhibition consisted of paintings, bronzes, antiquities and curiosities, contributed by the gentry of the neighbourhood, with the addition of several models and specimens of recent inventions, together with a collection of photographs from the Society of Arts. The exhibition was well attended, and has had an excellent effect.

Cambridge.—The half-yearly meeting of the Philo-Union Literary Society was held at the Society's rooms on Wednesday evening, the 19th ult., when the treasurer presented his report, by which it appeared that the finances of the society were in a most flourishing condition. The librarians also presented their report, showing the library to be in a very prosperous state, 60 new books having been added during the past half-year, and 2112 volumes issued to members during the same period. The following gentlemen were elected officers for the ensuing half-year:—*President*—Mr. Alderman Henry Smith; *Senior Vice-President*—Mr. A. Macmillan; *Vice-Presidents*—Messrs. John Bonnell, Charles Peach, and Charles Baxter; *Treasurer*—Mr. Owen J. Jones; *Secretary*—Mr. George W. Fitch; *Librarians*—Messrs. Thompson, Cooper, and G. Wilderspin.

Lewes.—The lectures at this Institution were commenced on the 27th of September, and have been continued regularly during the quarter. The attendance has been numerous and increasing. In addition to the usual course, the members were gratified by the delivery of an additional lecture, by Dr. Latham (through the influence of R. W. Blencowe, Esq.), on the "Poetry and Ethnography of the Fins." The large number of Fins now located in the war prison at Lewes, rendered this lecture exceedingly interesting. Lord Pevensey has intimated his intention of delivering a lecture during the Session, for the benefit of the Building Improvement Fund. The lectures delivered were, on "Some of the Physical, Social, and Political Changes that have taken place in the History of England," by Mr. R. W. Blencowe; the "Poetry and Ethnography of the Fins," by Dr. Latham; "Characteristics and Demands of the Present Age," by the Rev. N. Haycroft, M.A. (Bristol); "Song and its Influence," by Mr. Cunningham and Miss Payne; on "Light, the Eye, and the Microscope," by Mr. E. Wheeler; "Admiral Blake," by Mr. George Dawson; the "Ottoman Empire," by Mr. J. G. Dodson; on "David Copperfield," by Mr. Grossmith; on "John Milton," by the Rev. H. Crosskey; and on "Cause and Effect," by the Rev. U. de St. Croix.

Wandsworth.—A very interesting and useful lecture was delivered to the members of the Literary and Scientific Institution recently, by Mr. J. Bennett, F.R.A.S., on the "Birth, Parentage, and Education of a Watch." After giving an historical sketch of the gradual development in the art of measuring the lapse of time, from the water-clocks of the Greeks to the latest perfection of a chronometer, and lucidly explaining the construction and meaning of the various parts of a watch, the lecturer gave a description of his recent visit to the watchmakers of Switzerland, which he had been induced to make from witnessing the beautiful display of Swiss watches at the Great Paris Exhibition of last summer. His account of the education, mode of life, and division of labour among these industrious and simple-minded mountaineers, was exceedingly interesting, especially his practical application of the whole of the education question in this country. One imagines beforehand that a lecture on a watch might be rather dry, but those who attended this lecture appeared to be of a different opinion. Dr. Longstaff, in moving a vote of thanks to Mr. Bennett, characterised it as one of the most valuable ever delivered to the Institution. The vote was seconded by the Rev. H. Solly, and carried by acclamation.

To Correspondents.

Erratum.—Page 123, col. 1, line 2 from bottom, for "*not one house of any repute*," read, "*not any of the great houses*."

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Chemical, 8.
Statistical, 8, Colonel Sykes, "On the Commerce of British India."
Tues. Royal Institution, 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½.
Civil Engineers, 8, Mr. Henry Robinson, "On the Past and Present Condition of the River Thames."
Med. and Chirurg., 8½.
Zoological, 9.
Wed. London Inst., 3 Mr. Robert Grant, "On Elementary Astronomy."
Roy. Soc. Literature, 4½.
Society of Arts, 8, Mr. G. F. Wilson, "On the Manufactures of Price's Patent Candle Company."
Chemical, 8.
Thurs. Royal Institution, 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.
Fri. Philological, 8.
Royal Institution, 8½, Mr. W. R. Grove, Q.C., "Inferences from the Negation of Perpetual Motion."
Sat. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3½.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January* 11*th*, 1856.]

Dated 29th August, 1855.

1951. Charles Pope Rosson, Manchester—Improvements in machinery or apparatus employed for dressing and finishing textile fabrics, by the application of a new material in the place of hogs' bristles or wire cards, hitherto employed therein.

Dated 2nd October, 1855.

2197. William Horton, Birmingham—Improvements in the breech part of fire-arms.

Dated 5th December, 1855.

2739. William Henry Smith, Wellington-chambers, Cannon-street West—Improved construction of fastening, applicable to gaiters, stays, and other like articles.

Dated 6th December, 1855.

2741. Jonas Marland and Samuel Marland, Sun Vale Iron Works, Walsden—Improvements in power looms.
2743. William George Wilson, Penton-cottage, Newington Butts—A pneumatic moderator.
2745. Arthur Paget, Loughborough—Improvements in machinery or apparatus for the manufacture of looped or other fabrics.
2749. James Rock, junior, Hastings—Improvements in the construction of tents, huts, and portable buildings.
2751. Thomas Chaffer, Liverpool, and Jonah Ellis, Vulcan Foundry, near Warrington—Improvements in machinery for sawing and cutting slate, stone, coal, salt rock, or other minerals.
2753. Rudolph Bodmer, 2, Thavies-inn—An improved planimeter. (A communication.)
2755. Angier March Perkins, Francis-street, Gray's-inn-road—Improvements in apparatus for generating steam.
2757. Angier March Perkins, Francis-street, Gray's-inn-road—Improvements in warming buildings and apartments by hot water.

Dated 7th December, 1855.

2759. Antoine Latta, Metz—Preparing gutta percha in combination with other substances, applicable to various purposes.
2761. David Dick, Paisley—Improvements in machinery to be used in finishing cloth and textile fabrics.
2763. Hudson Cranston, Coronation-street, Sunderland—Improved method of manufacturing lozenges.
2767. James Leitch, 1, Ellenborough-street, Liverpool—Improvements in melting, blowing up, and filtering sugars and other saccharine matters.

2769. John Gray, Strand-street, Liverpool—Improvements in azimuth and amplitude instruments.
2771. Herman John Van den Hout and Ebenezer Brown, Kentish-town—Improvements in utilising leather shavings.

Dated 8th December, 1855.

2773. Charles François Jules Fonrobert, Berlin—An artificial leech and a sucker.
2775. William Norton, Kirkburton—Improvements in weaving pile fabrics.
2777. François Devos, 2, Rue Drouot, Paris—Improvements in preparing and tanning hides and skins.

Dated 10th December, 1855.

2779. Joseph Wrigley and Jacob Norcliffe, Oldham—Improvements in shuttles, and in the method of using the same.
2781. James Cocker, Liverpool—Improvements in the manufacture of wire.
2783. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of safety paper. (A communication.)
2787. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvement in the arrangement of the over-flow pipes of baths, wash-hand basins, and other vessels.
2789. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvement in the rising pipe and suction valves of pumps.

Dated December, 11*th*, 1855.

2791. Bernard Hughes, Rochester, New York, U.S.—A knot-tying sewing machine. (A communication.)
2793. Jean Marie Préaud, Lyons—Improvements in india-rubber springs.
2797. John Henry Johnson, 47, Lincoln's-inn-fields—Improved apparatus for discovering the leakage or escape of gas. (A communication.)
2799. Robert Adam Whytlaw and James Steven, Glasgow—Improvements in weaving.
2801. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for manufacturing bolts. (A communication.)
2803. Samuel Clarke, Albany-street, Regent's-park—Improvements in lanterns for affording light, and for cooking.

Dated 22nd December, 1855.

2900. Myles Kennedy, Ulverstone, and Thomas Eastwood, Preston—Improvements in pump buckets, which improvements are also applicable to lift pumps, air pumps, and all similar apparatus.
2902. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in furnaces for steam boilers and other heating purposes. (A communication.)
2904. Christopher Dresser, Waterloo-cottage, Waterloo-street, Hammersmith—Improvements in the mode of effecting what is called "nature printing."
2906. Edward Rowcliffe, 2, Gloucester-terrace, West-grove, Blackheath—Improvements in the manufacture of blocks or slabs for paving or building purposes.
2908. David Dick, Paisley—Improved regulator for gas.

Dated 24th December, 1855.

2910. Frederic Holdway, 12, Mount-street, Grosvenor-square—Improvements in carriages and various parts of the same.
2912. Thomas Cowburn and George Walker Muir, Manchester—Improvements in steam boilers, and in valves and parts connected therewith.
2914. Christian Ernst Offnaus, Newark, U.S.—Improvements in rotary steam engines.
2916. John Barton, Stockport—Improvements in shuttles or shuttle tongues.

Dated 26th December, 1855.

2918. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in railway axle-boxes. (A communication.)
2920. John William Lewis, Manchester—Improved picker for looms.
2922. Sylvanus Sawyer, Massachusetts, U.S.—Improved bomb shell.
2924. David McCullum, 3, Victoria-place, Stonehouse—Improvements in electric telegraphs.

Dated 27th December, 1855.

2926. Simon Petit, Versailles—Improved apparatus for buoying ships or vessels, and also drawing them out of water.
2928. Alfred Krupp, Essen, Prussia—Improvements in guns and gun carriages.
2930. Edwin Ladmore, Birmingham—Improved method of securing ramrods to military fire-arms.
2932. John Grist, Islington—Improvements in machinery for the manufacture of staves and parts of casks, and for forming them into casks, barrels, and other like vessels.

Dated 28th December, 1855.

2934. John Robinson, and Richard Cunliffe and Joseph Anthony Collet, Atlas Works, Manchester—Improvements in locomotive steam-engines, and in springs for locomotive steam-engines and other purposes.
2936. Thomas Fielding Uttley, Mytholm Royd, York—Improvements in the mode of applying fusible plugs to steam-boilers.
2938. George Chisholm, St. John's-square, Clerkenwell—Improvements in the manufacture of artificial manure.
2940. Henry George Baily, Vicarage, Swindon—Improvements in machinery for digging and forking land.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 10th, 1856.

1544. Henry Pratt.
1552. Thomas Wright Gardener Treeby.

Sealed January 12th, 1856.

1557. Benjamin Greening.
1558. John Robinson and William Wedding.
1560. Frederic Howorth Edwards.
1565. Romain Denis Obissier.
1566. Joseph Henry Tuck.
1568. Thomas Redmayne.
1571. George Tomlinson Bousfield.
1592. Ludovico Gavioli.
1620. Auguste Edouard Loradoux Bellford.
1623. Vincent Scully and Bennett Johns Heywood.
1627. James Gray Lawrie.
1646. Casimir Deschamps and Charles Vilcoq.
1648. William Striby.
1661. Rev. Theophilus Henry Hastings Kelk.
1673. Joseph Westwood and Robert Baillie.
1681. Tony Petitjean.
1718. François Georges Hyacinthe Levasseur.
1749. James Saunders.
1785. Samuel Cunliffe Lister.
1866. William Hudson.
1967. John Gedge.
2237. James Torry Hester.
2257. William Henry Lancaster and James Smith.
2277. John King Westropp and Edward Alfred Sharman.
2285. Henry Gardner.
2345. William Basford.
2362. Pierre Alexandre Leroux and Louis Réné Martin.
2498. Charles Hart.

Sealed January 15th, 1856.

1591. Antoine Regazzoli.
1594. Joseph Henry Tuck.
1614. William Smith.
1622. Vincent Scully and Bennett Johns Heywood.
1632. John Henry Woolbert.
1638. Samuel Stocker.
1742. Richard Archibald Brooman.
1756. Joseph Lane.
1762. Richard Albert Tilghman.
1784. Caleb Bedells.
1810. William Mickle.
1816. Auguste Morin.
1826. Charles Evans Reeves.
1828. Louis Turletti.
1848. Samuel Statham and Willoughby Smith.
1914. Frederick Scott Archer.
1940. William Johnson.
1954. Charles Radcliffe.
2278. Richard Albert Tilghman.
2464. James Greenshields.
2530. Joseph Scott.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 2nd.

45. Thomas Pape.

January 4th.

25. Charles Frederick Whitworth.
26. Francis Edwards.

January 5th.

36. Robert Whinery.
75. John Petrie, jun., and Samuel Taylor.
320. John Whitehouse, sen., and John Whitehouse, jun.
501. Edward Hammond Bentall.

January 7th.

59. Francis Parker and William Dicks.
82. John Arrowsmith.

January 8th.

69. Joseph Beattie.

January 10th.

71. Henry Constantine Jennings.
72. James Thornton, John Thornton, and Albert Thornton.
80. James Fletcher.
88. Frederick Lawrence and Alfred Lawrence.

January 12th.

93. John Rumley.
102. Frederick Joseph Bramwell and Isham Baggs

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3801	January 3.	Joints or Connections for a Stove	John Jobson......................	Litchurch Works, Derby.
3802	„ 3.	Pressure Guage	Edward Davis	Leeds.
3803	„ 16.	A Swivelical Screw Barrel Tilt...........	Richard Frost	8, Wilson-street, Gray's-inn-road.

Journal of the Society of Arts.

FRIDAY, JANUARY 25, 1856.

MEETING OF REPRESENTATIVES FROM INSTITUTIONS.

Friday, January 18, 1856.

On Friday evening, at six p.m., a meeting of representatives of Institutions in Union with the Society in the neighbourhood, or within easy access of London, was held, pursuant to the notice inserted in the *Journal*. The chair was taken by Dr. Booth, F.R.S., the chairman of the Council, who, after the Secretary had read the notice convening the meeting, explained that the object of the Council was to confer with those practically engaged in the management of Institutions and in the practical working of them, and to invite their co-operation in promoting the working and formation of classes, with a view to the subsequent examination of the members, such examinations to be followed by certificates as tests of merit in those examined. The lecture system was also open for discussion.

Letters from Mr. James Wilson, President of the People's College, Sheffield, were read, by which it appeared that lectures were a very subordinate part of the plan of that Institution, and that little importance was there attached to them, lectures being considered *instructional* rather than *educational*. The result of their experience went to show, that large numbers would "never be induced to attain or attempt a higher state of education than their *apparently* necessary state of life requires." It appears that examinations are about to be instituted there, and good results are anticipated from them, as likely "to lead to classified and systematic study." The writer further suggests examinations in those classes of study, through the different branches of which a student should pass, after which he might offer himself as a candidate for the Society of Arts examinations.

A discussion then took place, from which it appeared to be the general opinion that classes and class teaching were to be looked upon as the most important means, where practicable, of rendering the Institutions really efficient for the objects for which they are established. It was, however, urged by nearly all the speakers, that experience showed (and, indeed, it was unreasonable to expect it should be otherwise) that classes would not be attended simply for learning's sake. There must be some object in view. The most successful classes at Crosby-hall were those for the study of French and German, because the young men in the city of London, members of that Institution, were mostly engaged in the counting-house, where such acquirements had their value. Examinations were, doubtless, desirable as tending to render the study in classes less desultory; but examinations would not be generally and voluntarily undergone by individuals unless some definite object was to be obtained. Unless some direct benefits were to result to the candidate from the certificate to be awarded by the Society, and unless the certificate had some commercial value, it was the general opinion that the examination scheme would fail. It was considered, however, that the object would be attained by the Society procuring its certificates to be recognised by employers as testimonials worthy of credit; this would give the certificate a commercial value, which would render it worth competing for, and candidates for examination would, doubtless, readily be forthcoming. The Society was encouraged to proceed with its examination scheme.

With reference to lectures, it appeared to be the opinion of the meeting that, although lectures could not come into competition with class teaching, when classes were attainable, as a means of education, still even in that case they were considered as having a value as feeders to the classes; and when, from the character of the Institution, classes were impracticable, the lecture system was valuable as supplying information to those who had no other means of getting at it.

Some objections having been raised to the extensive and high range of the subjects as proposed in the Society's plan for examination, it was explained, as stated in the Society's memorandum, that the Council, in putting forth the list of subjects, desired to "indicate the extent to which it was hoped that the progressive improvement of the Institutions and the development of popular education might render it requisite to provide for the examination of candidates;" and that the Council had no expectation that for some time to come the Institutions would be prepared to present well qualified candidates for examination in many of the subjects: but, in the meanwhile, arrangements would be made for examination in such subjects as might be taught in the Institutions, and it was hoped that the range of subjects might be enlarged in each succeeding year.

The meeting was attended by the following members of Council and of the Institutes Committee:—Rev. Dr. Booth, F.R.S.; Messrs. W. Hawes; Matthew Marshall; I. J. Mechi, and G. F. Wilson, F.R.S.; Mr. A. Coleman, and Rev. F. Temple. Also by the following Representatives from the Institutions in the places named:—Barnet, Mr. S. J. Baldock; Basingstoke, Mr. Wyndham S. Portal; Battersea, Mr. R. Story, Mr. G. F. Wilson, F.R.S., and Mr. Samuel Bowes; Belmont, Mr. G. F. Wilson, F.R.S., and Mr. G. H. Spicer; Bexley Heath, Mr. Flaxman Spurrell; Bramley, Mr. T. J. Pearsall; Clapham, Mr. I. C. Buckmaster; Deptford, Mr. Alexander Dickson; Epsom and Ewell, Mr. George M. Coppard; Greenwich, Mr. David Bass, Mr. John Bell, and Mr. James Spencer; Hants and Wilts Education Society, Mr. Wyndham S. Portal; Kelvedon, Mr. I. J. Mechi; Lancaster, Mr. Robert Galloway; Lewes, Mr. Henry Brown; London, Bank of England Library and Literary Association, Mr. Matthew Marshall; Camden Literary Institution, Mr. John Yarnold; Crosby Hall Evening Classes for Young Men, Rev. Charles Mackenzie and Rev. Richard Whittington; London and South-Western Railway Literary and Scientific Institution, Mr. Fred. J. Macaulay; London Domestic Mission Society, Mr. J. M. Wade; London Mechanics' Institution, Mr. S. Vallentine; Tailors' Labour Agency Literary Institute, Mr. Joseph A. Dunn; Royston, Mr. John Warren; Sheffield, Mr. T. J. Pearsall; Stockton-on-Tees, Mr. T. J. Pearsall; Wandsworth, Mr. William Miles Medcraft; and Windsor and Eton, Mr. Joseph Lundy and Mr. Chas. Thos. Phillips.

SEVENTH ORDINARY MEETING.

Wednesday, January 23, 1856.

The Seventh Ordinary Meeting of the One Hundred and Second Session, was held on Wednesday, the 23rd instant, Dr. Lyon Playfair, C.B., F.R.S., Vice-President, in the chair.

The following Candidates were balloted for and duly elected :—

Abel, F. A.
Cohen, Henry Louis
Corbet, Henry
Dickson, William
vill, William
E
Finch, Frederick Cotton, M.D.
North, Robert Samuel
Temple, Rev. Frederick

The paper read was

ON THE MANUFACTURES OF PRICE'S PATENT CANDLE COMPANY.

By G. F. Wilson, F.R.S.

I was asked to give a paper this session, and allowed to choose my favourite subject, the Manufactures of Price's Patent Candle Company.

As a member of Council I have been present at most of the late meetings. In my individual opinion, the Wednesday evenings, while they constantly increase in interest, are becoming too long; I have, therefore, made mine a short paper.

I will begin with the principal manufacture of the Company—Candles.

Candles may be divided into four classes:—

1. Beeswax, called wax candles.
2. Neutral fat, including spermaceti, tallow, and cocoanut candles.
3. Fat acid, known as stearic candles; and
4. Composite candles, being a mixture of stearic acid and neutral fat.

It is to the 3rd and 4th classes, the stearic and composite candles, to which, as forming the principal manufacture of the Company, I have first to direct your attention.

Notwithstanding all that has been written about candles, especially in the excellent Jury Report of the 1851 Exhibition, not one out of ten educated persons could answer the question, why a tallow candle requires more than three times the size of wick, to give the same amount of light, as a stearic candle; and if the tenth gave the right answer, namely, that it is owing to the glycerine being present in the one case, and having been separated in the other, the nine would be little the wiser. As a knowledge of common things is now considered desirable, I will endeavour to show the effect of the presence of glycerine, by means of some specimens, and will take tallow, as being the fat most generally known, for the example. Tallow, as it is separated by boiling from the fat of cattle or sheep, is composed of, at least, two distinct solid bodies, one liquid oily body, and a syrupy body.

The first solid constituent is called stearic acid, the second margaric acid, the liquid oil oleic acid, and the syrupy body glycerine, which serves as a base to the three acids.

On the table are specimens of tallow, stearine, margarine, oleine, and glycerine, and of stearic, margaric, and oleic acids, each having a plaited wick of the same number of threads of cotton. You will see the different power of illumination, in the great flame of the stearic, of the margaric, and of the oleic acids, in the feeble flame of the tallow, of the stearine, of the margarine, and of the oleine, and the hardly visible flame of the glycerine.

The glycerine is thus shown to have the effect of reducing the illuminating power of candle material; to get rid of or separate the glycerine for the purpose of obtaining the more valuable material for candles, was the necessity which first called in the aid of science to candle-making. Science, once introduced, has raised candle-making from a simple, clumsy, offensive, mechanical trade, into a first-class chemical manufacture, one offering the widest field for applications of the highest chemistry.

The time must soon, if it has not already, come, when a well-organised laboratory, and a thorough acquaintance with the works of the high scientific chemists, and even communication with some of themselves, will be considered necessary elements of candle-making success.

Of science applied to candle-making, Chevreul, the great French chemist, was, as is well known, the father. Candle-makers are bound, on all occasions, to offer their tribute to the wonderful accuracy and foresight of his early scientific experiments and writings.

My respect for him was lately put to a severe trial, which, however, it stood, when, in the splendid show at the closing of the Paris Exhibition, I had to see him walk up to take the medal which jury, group of juries, and council of presidents had voted to us, and which I had gone over to Paris to receive.

M. Chevreul's labours began in 1811, and were collected and published in his "Récherches Chimiques sur les Corps Gras," in 1823; in 1825, in conjunction with Gay Lussac, he attempted industrial applications of his scientific researches, and took out a patent in England, but did not succeed.

The first notification we have of fat acid or stearic candles commercially successful, was in a report made to the Society of Encouragement in Paris, in 1833, which stated that Messrs. Motard and Milly had succeeded in purifying an acid from tallow, of which they made candles, called "bougies de l' étoile," of which the manufacture and sale had risen to about 25 tons annually, while their price, 1s. 6½d. wholesale, 1s. 8½d. retail a pound, was sufficiently low to ensure them the preference they had begun to obtain. On the strength of this report, the "Society of Encouragement" voted a silver medal to MM. Motard and Milly.

The process employed by them for separating the fat acids from their glycerine, which was afterwards adopted by the English candlemakers, E. Price and Company among the number, was called lime saponification, and was shortly this:—

Tallow was boiled up with thin cream of lime, which caused the fat acids, by superior affinity, to forsake their glycerine to combine with the lime, the glycerine dissolving in the water; this combination was then broken by means of sulphuric acid, which, seizing on the lime, set free the fat acids; these were then separated, the liquid from the solid, by means of pressure.

This was an expensive process, as to each cwt. of tallow, 14 to 16 lbs. of lime, and 28 to 32 lbs. of sulphuric acid, were employed, and the candle material, stearic acid, when obtained, was only in the proportion of two parts to five of the tallow employed, and the other product of the tallow was a comparatively refuse oil.

I will now proceed to the candles of Price's Patent Candle Company. When on a a former occasion, in 1852, I had the pleasure of reading before the Society a paper upon a somewhat similar subject, I took the opportunity of answering in it some of the most common of the questions put by visitors at our works; having found the benefit of this, I will take the same liberty on the present occasion.

One very common question is, who was Mr. Price, or, put as it often has been by our French friends, M. Preece. As, I believe, this has never been answered, except verbally, I shall beg to do so now. Mr. Price never was anybody. In the days of the early establishment of our factory, besides business reasons, it would have been considered *infra dig.* for one who had been a merchant to become a candle-maker; my father and his partner, therefore, adopted the trading name of E. Price and Co. In 1847 the great India house, of which some of the partners were at that time partners in E. Price and Co., getting into difficulties, and the extended scale of work requiring increase of capital, the concern was sold to a Joint Stock Company, which took the name of Price's Patent Candle Company.

In the month of October, 1840, from which time I can speak from personal knowledge, we employed 74 men and 10 boys, and manufactured about 20 tons of cocoa-nut candles, value £1590, and about 12 tons of stearic and composite candles, value £1227, during the month.

In the corresponding month of 1855, we employed 1098 men and 1191 boys and girls, and manufactured of stearic and composite candles and night-lights about 707 *tons*, value £79,500, in the month.

I will now shortly trace the steps of progress, and have the less scruple in doing so, as they give not merely the history of a single establishment, but as grafts from the Belmont tree have been carried and are now growing all over the world, in France, Russia, America, Germany, Belgium, Holland, and Spain, a sketch of our progress is in fact that of an important new manufacture.

I shall not spend much time in tracing what was said and written by the French chemists and manufacturers, as nothing was put in practice by them before 1846 or 1847.

A patent trial in France, reported in the *Gazette des Tribunaux* of March 16th, 1851, fixes the date of the industrial introduction of fatty distillation into France as being in 1846 or 1847.

It is true that, had we studied some of the early suggestions of French chemists, our progress would have been more rapid and far easier. It is equally true that had Chevreul or Dubrunfant never spoken of fat distillation, we should have been exactly where we now are, not one step either more backward or more forward. We began fatty distillation at its beginning, and worked it out for ourselves, first, in a glass retort, then in a common still, heated by the naked fire, and experienced all the evils of the decomposition of glycerine and consequent evolution of acroleine, and of the decomposition of a part of the fat acids; we were, however, led on by the happy circumstance that our trade at that time being principally connected with cocoa-nut oil, our experiments were for the most part directed to that fat, the acids of which, from their comparatively low boiling point, distil over with but little decomposition, even when exposed in the apparatus to the action of the air. We thus obtained more favourable results than would have been arrived at if other fats had been operated upon.

The first important move in candles, following after De Milly's stearic acid candles, was the introduction of the now well-known composite candles. These were at the commencement of their manufacture composed of equal parts of stearic acid and of the hard part or stearine of cocoa-nut oil.

Their origin was this:—

On the occasion of her Majesty's marriage, in 1840, a great want arose for cheap self-snuffing candles for the window illuminations. My brother, J. P. Wilson, tried a mixture of the stearic acid and cocoa-nut stearine, both of which were being manufactured by E. Price and Company, and made, in their separate state, into candles, but never previously mixed; the public, contrary to the general opinion of the candle-dealers, proved wise enough not to mind the candles being greasy, but as the light was good, the candles comparatively cheap, and the nuisance of having to snuff done away with, they received the new composite candles with great favour, and the manufacture rapidly grew.

As no patent was taken out for the mixture of the fat acid and the neutral fat, other manufacturers soon made composite candles, by substituting cocoa-nut oil in its crude state for the cocoa-nut stearine used by E. Price and Company.

The next great move was fatty distillation and its attendant processes put into practice.

Chevreul and Gay Lussac had, in 1825, sketched out the idea of distillation of fatty bodies, and had even touched lightly on the introduction of steam into the distillatory apparatus. The idea of distillation then lay dormant until March 1840, when Mr. George Gwynne revived it, and took out a patent, the specification of which drew particular attention to distillation, especially for the purpose of purifying the fatty acids, and showed a point to be aimed at, the exclusion of the air from the apparatus while distillation was going on, the method he proposed being to exclude the atmosphere by means of an air-pump.

I believe this method was never carried on commercially on the large scale.

In a small apparatus I have seen it worked effectively.

More than a year afterwards, Dubrunfant, a French chemist, took out a patent in France, and one in England in the name of Mr. Newton, for purification and distillation of fatty bodies; the specification of this patent we met with for the first time in 1843, when, as is the custom of patentees, searching the records of the Patent Office before putting in the specification of our patent of 1842.

Afterwards, when some French manufacturers had introduced practical distillation into France, in 1846 or 1847, from imperfect information derived originally from our factory, through sources which we can happily trace, they fell back upon the unworked patent of Dubrunfant, and claimed priority.

In 1842, Edward Price and Co. took out a patent in the name of Mr. W. C. Jones, a working chemist, whom I had brought in as an assistant, for distilling cocoa-nut oil and its acids, and also for converting them into a neutral substance by distilling them after combination with lime.

Candles, beautiful in appearance, were made by distilling the cocoa-nut acids, but on putting them out, they gave off a choking vapour, which produced violent coughing. We consulted my old master, Professor Daniell, of King's College, upon this, who gave it as his opinion that the vapour was that of the fat acid itself, and recommended us to try dowters, the old-fashioned flat snuffers, hoping to extinguish the candles instantaneously. This lessened the evil, but did not entirely remove it; the candles were therefore never brought into the market.

Under the last part of this patent, distilling cocoa-nut lime soap, we made beautiful candles, resembling those made from paraffine, burning perfectly, but the loss of material in the process was so great, that the subsequent improvements superseded its use.

Under one part of this patent the distillation was carried on, sometimes with the air partially excluded from the apparatus, by means of the vapour of water, sometimes without, the low evaporating point of the cocoa-nut acids rendering the exclusion of the air a matter of much less importance than when distilling other fat acids.

It was during experiments connected with this patent that Mr. Jones and I first tried using vapour of water to exclude the air from the apparatus during distillation.

In distilling the cocoa-nut acids, combined with lime, in a small gun-metal retort, we found that the product of distillation was light-coloured only so long as the water mixed in the lime soap distilled along with it. We then fixed a cup on the top of the retort, out of which water slowly dropped; this produced the anticipated effect of increasing the yield of light-coloured material.

In 1842, E. Price and Co. took out a patent in the name of Mr. Jones and myself, the principal claims of which are the distillation of fats previously acted on by sulphuric acid, or by nitrous gases. This patent contains an original mode of acting upon fats by sulphuric acid at a high temperature.

M. Frémy, in his valuable paper in the "Annales de Chimie," describes treating oils with half their weight of concentrated sulphuric acid, by which their melting point was greatly raised. He gave, however, particular directions that the matter under process should be kept cool. Instead of doing this, we found it advantageous to expose the mixture of fat acid and fat to a high temperature, and we still do so. M. Frémy lately informed me that he is again at work upon fatty bodies. I need hardly say, that so able a chemist cannot work in vain on a subject he is so well up in.

While Mr. Jones and I were experimenting under this patent in one part of our works, Mr. Gwynne was at work in another, with a small silver retort connected with an air pump. His object was our carrying out on a large scale his patent of 1840 (under which we had taken a licence), but finding that steam excluded the air as effectually as the air pump, and with much fewer manufacturing difficulties, we combined our forces upon this, and in 1843 took out two patents for improvements in the processes and apparatus, under which part of our manufacture is still carried on.

In 1844, E. Price and Co. took out a patent for the use of diluted acid in direct acidification of fats. I only mention this on account of having heard that the idea has been lately revived in France.

Our process of sulphuric acid saponification was as follows. We still employ it, and in some cases reduce the quantity of acid employed to 4lb., and even 3 lb. to a cwt. of the fat. Six tons of the raw material, usually palm oil, though occasionally we work cheap animal fat, vegetable oils, and butters, and Japan wax, were exposed to the combined action of 6¾ cwts. of concentrated sulphuric acid, at a temperature of 350 Fahrenheit. In this process the glycerine is decomposed, large volumes of sulphurous acid are given off, and the fat is changed into a mixture of fat acids of a very dark colour, with a high melting point. This is washed, to free it from charred matter and adhering sulphuric acid, and is then transferred into a still, from which the air is excluded by means of steam. The steam used by us is heated in a system of pipes similar to those used in the hot-blast apparatus in the manufacture of iron, the object of heating the steam being only to save the still, and reduce to a small extent gaseous loss in distillation. On the table are specimens of this process.

1. The palm oil fruit, for which I am indebted to the kindness of Sir Wm. Hooker.

2. The raw palm oil; it is, you see, of a bright orange red colour, and of about the consistence of butter.

3. The palm oil, after the acid treatment and washing. You see it is almost black, and very hard.

4. The last product distilled.

5. The residuum of distillation.

Thus, you see, distillation separates the black acidified palm oil into the pure fat acids, which come over in vapour, leaving the charred matters, and other impurities which are not volatile, behind in the still. All who have blown out a candle know the unpleasant smell of fatty matter distilling in contact with the air. That tallow candles give off a more offensive vapour than stearic ones, is owing to the presence of glycerine.

We have stills bringing over their charges of above five tons without any unpleasant smell, owing to all access of air being excluded. The distilled material is either used for making the cheaper descriptions of candles, or is subjected to hydraulic pressure, first at the temperature of the air, and then at a high heat.

That which remains after hot pressure, is used, after removing by diluted acid any rust it has taken up from the iron press plates, for making what are known as Belmont Sperm Candles.

Our brothers across the channel, with their many good qualities, understand how to make the most of themselves, as they themselves term it, "se faire valoir."

At the Exhibition of 1851, a French firm appeared as competing with us for the honour of the introduction of practical fatty distillation and sulphuric saponification. The case they made, though it did not gain them the Council Medal, told very much against our getting it.

It was impossible not to be impressed with the number of kilogrammes they worked weekly, the low quality and cheapness of their raw materials, and the description of their workings, given by two distinguished French chemists, in a valuable chemical work. Their products were nothing very striking. Within six months of the closing of the Exhibition, it appeared that, notwithstanding the number of kilogrammes worked, the cheapness of the raw material, and the tribute of the chemical book, the undertaking was unsuccessful; the manufactory was put up for sale at a price considerably less than the first cost of its machinery. My brother went over to see it, and one great reason why we did not buy the place was, that the apparatus was so imperfect, that it would have been cheaper for us to put up new plant than to perfect that which had been employed.

We had, thus, now arrived at a process by which the fat acids were set free from the glycerine, with but small cost for the chemical agents employed; and these fat acids, by the after-process of distillation, converted into valuable material for candles. This was a great move forward. The process, however, involved waste of the glycerine, and a considerable loss of material, owing to decomposition of a part of the fat acids.

I have now to direct your attention to processes intended to overcome these last-mentioned defects.

In January, 1854, Mr. Tighlman, an American chemist, who has studied all that has been published here and in France, on the subject of acidification and distillation of fatty bodies, obtained a patent for exposing fats and oils to the action of water at a high temperature, and under great pressure, in order to cause the combination of the water with the elements of the neutral fats, so as to produce at the same time free fat acids and solution of glycerine. He proposed to effect this by pumping a mixture of fat and water, by means of a force pump, through a coil of pipe heated to about 612 Fahrenheit, kept under a pressure of about 2,000 lbs. to the square inch; and, he states, that the vessel must be closed, so that the requisite amount of pressure may be applied to prevent the conversion of water into steam. This is, as all must admit, a beautiful, original, chemical idea, well carried out; it has yet to be proved how far it can compete successfully with distillation. We have made an arrangement with Mr. Tighlman which will give us the means of testing its commercial merits.

I went with my chemist-assistant, Mr. Payne, to see Mr. Tighlman's little apparatus at work, and in the course of some experiments which it led us to try, or rather to try over again, it struck me that steam, passed into the fat at a high temperature, should effect by a gentle process what Mr. Tighlman aimed at effecting by a violent process, the resolving of the neutral fat into glycerine and fat acids. We proved that this was so, and that the glycerine distilled over in company with the fat acids, but no longer combined with them.

In July, 1854, we took out a patent for this process, by which many hundred tons of palm oil and other fats have now been worked, and which has given to the arts and medicine a body never before known, either in France or here, even in the chemists' laboratory, glycerine, which had passed over in the form of vapour, without a trace of decomposition.

I did not see why glycerine, if it would distil once, should not distil again; experiment showed that it might be re-distilled. We took out a second patent for this, and now use this process in place of all other modes of purifying glycerine.

In the old days, glycerine was looked upon as a nuisance, something to be got rid of at a great expense; it now proved to have been only the right man in the wrong place—for artificial purposes, that is—for in nature nothing is in the wrong place. The despised glycerine is now more valued, and sells at a higher rate, than its early-prized associate, the stearic acid. We have reason to hope for great results from these new processes; before them the glycerine sold even at a very high price, more than three times the present price, was not pure, and the generality of specimens were very impure.

At the suggestion of the Vice-President who this evening occupies the chair, I read a paper at the British Association meeting in Glasgow, in which endeavour was made to bring forward all the information which I could collect respecting this as yet little-worked body. As the paper was copied into our Society's *Journal*, on September 28th, 1855, I may assume that members likely to be interested in the subject saw it. I will, therefore, spare you the infliction of going over the ground again, merely reverting to those points which have received any development since the date of the Glasgow paper.

Mr. Startin, to whom glycerine owes so much, from his having introduced it in 1844 into the Hospital for Skin Diseases, from whence its use spread, has kindly furnished me with the particulars of a great number of medicinal uses, which were new to me, and many others in which he had anticipated M. Cap. These are set out at length in the *Medical Times*, vol. 21, p. 27, January 12th, 1850. He also informs me that the notion of its use as an embalming agent is an old one, its antiseptic properties having been one of his earliest observations. When the young hippopotamus first came over, it was arranged between Professor Owen and Mr. Startin, that, should it unhappily die, glycerine injected was to be used for its preservation.

In photography, Mr. Maskelyne, of Oxford, tried a number of promising experiments with distilled glycerine. Other engagements interfering, he passed the subject over to Mr. J. D. Llewelyn. That gentlemen has favoured me by communicating his present views in the following words, which, coming from so distinguished a photographer, I am happy in being allowed to quote. He writes, "I have made now about 200 carefully-registered trials, and continue to be persuaded that it will prove a most valuable photographic agent. In conjunction with honey it works admirably, and is thus an important improvement on Mr. Shadbolt's process, rendering the preservation film far more soluble in water than the honey alone." In medicine, I am informed, that all fear of danger from internal administration is over. One of the principal Edinburgh druggists writes, that the medical men are prescribing it in doses of three desert, and even three table-spoonsfull daily. This is not the place for medical discussions, and if I went into cases, perhaps some members present might be induced to doctor themselves without previous competent medical advice, of which I must beg to decline the responsibility. As a cure for chapped hands, it keeps constantly growing in favour.

I have never seen it tried on a burn, but I lately received a letter from a gentleman in Liverpool, which stated that, applied on a severe scald from boiling water, it acted as an immediate charm, and when the surgeon arrived he was astonished at the effect produced.

Dr. Davy has kindly favoured me with the information and the permission to mention the fact, that Sir John Richardson has lately used glycerine with benefit in cases of confluent small pox; applied to the face, he believes it retarded the eruption, and had the effect of diminishing the pitting on healing. I have also heard of its application in cases of erysipelas with reputed good effects.

Since the above was written, I have been favoured with a letter from Mr. A. W. Dickson, of Edinburgh, giving the particulars of a case of affection of the mucous membrane, which occurred in his practice, in which glycerine was given, a table-spoonful three times a day, and appears to have worked wonders. He informs me, too, that the well-known Dr. Simpson is anxious to settle the question of the fattening powers of glycerine, and for that purpose makes a proposal which we shall willingly accept. Dr. Simpson is to get a litter of pigs, to give glycerine freely with the food to two of them, cod liver oil to other two, and the ordinary diet to the others, and weigh them from time to time. The doctor offers to stand the pigs and the watching, if we stand the glycerine, which, for such an object, we shall gladly do.

It ought to be useful in making infusions and extracts. You will observe the brilliant colour of the liquid at the top of the bottles, containing passion-flower fruits, reaching about an inch down; and any member who likes to taste, or even to smell the glycerine in the glass-jar containing apples, will perceive that the apple flavour has been extracted. Its power of preserving the colour of animal and vegetable substances is shown by the specimen on the table. The roach and perch, (see the labels on their bottles), have been immersed since July and August; their colours are still quite bright.

The Rev. John Barlow, F.R.S., has very kindly allowed me to exhibit his specimens of beefsteaks preserved in glycerine. Mr. Barlow's well-known experiments on this subject are detailed in his paper, read at the Royal Institution, on March 30th, 1855.

The bananas were immersed on the 1st October. The unripe green colour which, exposed to the air, changes to yellow in a day or two, is here preserved; the flowers were put in on December 3; you will perceive that many of the colours are bright; the Cape gooseberries, put in October 30, are perfect. For the specimens of English-grown bananas, for the fine apple, and the Cape gooseberries, and for the two vases containing various flowers, I am indebted to the kindness of Lady Dorothy Nevill; her ladyship informs me, that in her experiments in preserving fruit and flowers, she finds that glycerine diluted with twice its bulk of water gives the best results.

Sir Wm. Hooker favoured me with an account of his experiments upon preserving delicate fruits in glycerine. At first it promised well; he found glycerine mixed with an equal portion of water, to give better results than concentrated glycerine; the longer trial, however, showed it to be, for his purposes, inferior to pyroligneous acid.

On the table are specimens of the principal descriptions of candles manufactured by the Company:—

Belmont sperm—made of hot-pressed, distilled palm acid.

Belmont wax—the same material, tinted with gamboge.

Best composite candles—made of a mixture of the hard palm acid, and stearine of cocoa-nut oil.

These last candles are not hard to the touch, or fit for use in hot climates, but give, perhaps, a pleasanter light for reading by than any other description of candles, the larger proportion of hydrogen in the cocoa-nut correcting the reddish light of the palm acid.

Composites Nos. 1, 2, and 3, are made of palm acids, and palm acids and cocoa-nut stearine, the relative proportions varying according to the relative market prices of palm oil and cocoa-nut oil, at the particular time at which the candles are manufactured.

No. 4 composite is a description of candles we have very recently introduced, intended to supply a want caused by the present very high prices; a candle giving a good light, and yet to be bought at very little above the price of tallow dip candles; they are, as will be seen, of a very dark colour.

Candles are commonly packed in single pounds by the foreign manufacturers; these packets now usually contain candles weighing only from 13 oz. to 15 oz. The Company are about to adopt two sizes of packets for the export markets, where they meet the foreign manufacturers, one labelled prominently as weighing 1 lb. of 16 oz; the other labelled prominently as weighing ¾ lb. or 12 oz., of a smaller size of candles. It may be hoped that this will restore the original pound packets; at present they are going the way bottles have gone.

I should not have said anything about what is now an old story, the use of arsenic in candles, its use and the object of its use having long ceased, had it not been for the fact that when the English public once gets an idea into its head, there is great difficulty in getting it out again; and that I lately heard it said that Sir Edward Belcher, in his last Arctic expedition, believed that his crew suffered from candles giving off arsenic. Many years ago it was believed, and said, that when stearic candles were first lighted there was no escape of arsenic, but that when the candles had burnt nearly down, the arsenic having settled to the bottom, gave off a most offensive vapour. The fact that the top of the candle, when burning, is the bottom of the candle when in the mould, where the supposed settlement must have taken place, rather disturbed this theory. Probably, the candles used in the expedition were of a common description, and gave off, not arsenic, but smoke, which candle smoke, in a confined situation, is most unpleasant, and quite sufficient to produce nausea. I think it hardly possible that the candles could have contained arsenic. The reason for the use of arsenic, in the old days, was this—the candle material used to be poured into the moulds at so high a temperature, about 240° Fahrenheit, and was so long in congealing, that crystallization of the stearic acid would have taken place and disfigured the surface of the candles, had not some means been employed to prevent perfect crystals being formed; the means at that time employed were wax, or a small quantity of arsenic and wax, which gave a compact homogeneous appearance to the candles.

In modern candle-making the material is poured into the moulds at so low a temperature that congelation has already begun, which prevents the formation of perfect crystals more effectually than arsenic and wax ever did; there is now absolutely no more object for introducing arsenic into stearic candles than for introducing it into tallow dips.

I am sorry not to be able to give information worth anything as to the candles shown in the Paris Exhibition, though I very carefully examined them.

The processes of stearic manufacture are now so far advanced that any manufacturer can, even on the large scale, produce and exhibit stearic acid chemically pure; the whole question, therefore, turns upon the cost of manufacture. This cannot be arrived at until the jury reports are published, nor even then, I fear, with any degree of certainty; it is only in quite exceptional cases that manufacturers will so far disclose the secrets of their manufacture as to give anything like accurate data for comparison.

As to the Company's manufactures exhibited, and the gold medal of honour which they did, and the great gold medal which they did not, receive, I propose to mention the bare facts as they occurred, making no comments. There was much discussion in Paris on the awards. I have no doubt of the accuracy of the following information, which I gleaned from various sources. The Company were invited to exhibit in a building, the name of which is "Palais de l'Industrie." They were informed that their products would be submitted to the judgment of the jury, the group of juries, and the council of presidents. They exhibited specimens of a chemical manufacture raised by them, now carried on on an immense scale, and also specimens of a new chemical process fully developed, and at work on the large scale, and which gave results, one of which even Chevreul never foresaw, and which had never before been seen in France—pure distilled glycerine.

The jury, the group of juries, and council of presidents, awarded the highest recompense of the Exhibition, the "*grande medaille d'honneur,*" and a notice was sent by M. le Play, the French commissary-general, directing that the Company's specimens should be moved from their position in the Annexe into the nave, to be brought under the notice of the Emperor, which, I am told by jurors, is something very like equivalent to an official notice of the highest recompense having been awarded.

At the last moment, a new tribunal, the Council of Seven, was established; this first passed the medal awarded to the Company, and then transferred it to M. Chevreul, who does not appear as an exhibitor, giving the second gold medal of honour to the Company. I am told by French friends that the Council of Seven were placed in a position of difficulty, owing to too many great medals having been awarded by some of the juries.

The English commission were good enough to break the fall, as far as lay in their power to do so, by admitting the Company's specimens into the English trophy at the grand closing scene, so that Belmont was, after all, well represented by its stearic candles seven feet high, towering above everything and everybody.

These international exhibitions, while they often create soreness, seem to do good, by bringing people of different nations in contact. Our perhaps keenest French opponent at the Exhibition of 1851, is now a friend, whom my brother and I are anxious to serve, as I believe he is to serve us.

Another considerable branch of the Company's manufacture is night-lights. Before 1848 we made these in but very small quantities.

In 1848, we commenced manufacturing under Mr. Clarke's patent, with improvements introduced by ourselves.

In 1849, we made an arrangement with Mr. Childs for purchasing his machinery and business, and commenced manufacturing the night-lights known as Childs' night-lights. Between these two descriptions of night-lights we organised a manufacture on a sufficiently extensive scale to give us the power of selling night-lights with profit to ourselves, at prices at which they could not be produced on a small scale.

On the table are specimens of a newly-invented description of night-lights, which we believe will remove the one great defect of the existing night-lights—the flickering of their light.

The excise laws, utterly bad as they are, have on many occasions, like necessity, been the mother of invention. The heavy cost of paper, loaded as it is with 1½d. a lb. of duty, led to Mr. Geeves inventing a mode of cutting wood in slices thin enough to serve as an efficient economical substitute for paper. These were applied by Mr. James Childs to night-light casings, and are now cut on a very large scale by the Company, and used in the place of one surface of paper for their night-light covers.

On the table are specimens of the shavings, four feet by one foot, 160 cut from an inch plank.

The heavy paper duty puts a bar on our making the paper cases so generally used by the French manufacturers for their 1lb. packets. In our manufacture as it is, we paid last year 1½d. a lb. duty on 358,272 lbs. of paper, amounting to £2239, with the extra 5 per cent. to £2350; but, perhaps, in the present time, we ought rather to be thankful for the soap excise having been removed, than to grumble at the paper one which remains.

Another extensive branch of the Company's manufacture is oil—for burning, for lubrication, and for oiling the wool used in the great cloth mills of Lancashire and Yorkshire.

This manufacture has afforded room for many applications of chemistry. I could tell little, however, that would be otherwise than utterly uninteresting to a general audience. I will, therefore, confine myself to a very few words upon the last branch.

The applications of oleic acid to the purpose of greasing wool, was originally a French invention, patented in this country. We adopted it, and have added some important recent improvements; it is a part of our business upon which care and labour has been bestowed. Had this substitute for olive and rape oils not been introduced, the failure of the olive crop, and latterly the high price of rape oil, would have entailed a serious charge on the cloth manufacture.

The French moderator lamps are now deservedly in so extensive a use, that I thought it might be interesting to those members who do not understand their construction, to have the opportunity of seeing one with a transparent pedestal, allowing the works to be seen. Messrs. Pearce, of Ludgate-hill, kindly lent me a lamp for this purpose; the oil burning in it is rape oil imported by them.

The only drawback I know of to the moderator lamps is, that with some of the shades used, they hurt the eyes when used to write by,—at least my lamp does.

I must say a few words about the Crimean army stoves and lanterns, which, last year, formed a not very small branch of the Company's manufacture; they were contrived, in haste, to supply the very urgent want for a not very expensive portable fuel for giving warmth and cooking power for the army in the East. Delay, perhaps partly unavoidable, prevented their getting out in time to be of any great general service. We continue, however, to receive reports from officers expressing themselves most warmly as to their merits, especially speaking of the lanterns. I should wish to guard against its being conceived that they were ever intended for use where the more economical sources of heat, such as coal or gas, could be procured. The only one of the inventions which we brought out at that time, which seems at all likely to survive the emergency which gave it birth, is the candle stove, of which a specimen is on the table. This was contrived on Mr. Brunel expressing a want for some arrangement which would give a supply of hot-water in different parts of the hospital, at Smyrna, which he had the charge of erecting.

I think for those occasions where coal is expensive, or where a chimney is impracticable, there is, perhaps, more heat in proportion to the products of combustion given off in this way than in any other, with the exception of spirit lamps.

Since this was written, Col. Sir Charles Shaw has confirmed this opinion, and has suggested a very promising modification of the arrangements applicable to the purpose of cooking for the army, in countries where wood fuel is not easily procurable.

We have almost succeeded in perfecting an economical candle lamp for the railway carriages; there is a specimen of the lamp and the dumpy candle on the table.

I beg to call attention to the flower vases on the table, ornamented with crystals of the palm acid, palmitic acid, deposited between two surfaces of glass.

I have now finished the account of the Company's products. As my former paper was attempted to be used to the disadvantage of the company, I may be allowed to guard the present one, by drawing attention to the fact that the Company's dividends do not exceed a fair manufacturing profit on the capital invested, and that their new machinery now completed is sufficient to supply any possible demand for their products. Connected with the manufactures of the Company, are the endeavours they have made to raise up a set of improved and contented workpeople. This comes hardly within the scope of the present paper, nor, indeed, within my department of the business, it having been originated by my brother, and worked by him, aided latterly by the very liberal grants of the Company.

I will merely mention that the educational and improvement work is going on most happily at the London factories, and in our recently established colony on the Mersey, the new Bromboro' Pool Works.

It has always been the endeavour of the Company to encourage and assist, as far as possible, the introduction and importation of new fatty materials, vegetable and animal; they may take this opportunity of making their acknowledgments for the very valuable assistance which the Kew Museum has afforded them, and for the full, prompt answers Sir Wm. Hooker has always given to all applications respecting new oil seeds; to Dr. Royle, for his valuable information respecting Indian products; and to Miss Gurney, for the very useful information she has obtained respecting the oils and oil seeds of Western Africa. A few years back, at the suggestion of Sir Wm. Hooker, I noted down a few simple directions, some of which I propose to repeat, in the hope that, through the medium of our *Journal*, they may reach some member of this now widely-spread Society, who may be in a position to aid the object I had in view.

"In times of peace, with tallow at average prices, every oil, or grease, whether solid or liquid, if not poisonous or acrid, like croton oil, or viscid and gummy, like castor oil, or drying, like linseed oil, may be considered to be worth in London at least £30 a ton. Among greases solid at above 60° Fahrenheit, the higher the melting point (other things being equal), the greater the value; for example, the vegetable tallow of Borneo, melting at about 90° Fahrenheit, is worth at least £5 a ton more than the cocoa-nut oil of Ceylon, melting at 70°. It is difficult to say to what extent the soap duty having been taken off may change the relative values of greases; but, in peace times, liquid oils like the ground nut are worth more than soft solid oils, like the Bassia butter of India, as they require less manufacturing to fit them for use, the liquid oils, after a simple treatment in a cheap apparatus, being fit for burning in lamps, while the soft solid oils, being neither hard enough for use in candles, nor liquid enough for use in lamps, require to go through a press before they are saleable, except for soapmaking. Greases may have particular advantages, such as being little acted upon by the air, and therefore not easily becoming rancid, good qualities, which can only be ascertained by experiments, which we shall be happy to try. The value of oil must depend a little (especially when found in out-of-the-way places) upon the way it is held in its matrix; for example, the oil of the Lumbang nut can be separated with much less labour and simpler machinery than the cocoa-nut oil, which requires very great pressure to extract it from the copperah, or dried cocoa-nut kernel.

"Waxes are worth more than greases, on account of their very high melting points; their relative values depend upon colour, transparency, and freedom from resinous matter. Resin may be easily detected by lighting a small piece of the wax; the more smoke, the greater proportion of resin, and therefore less value; the paler and more transparent the wax the better. The most valuable tree-wax yet known is the beautiful insect-wax of China.

"A simple way to try an oil nut is to crush it with a stone, and then squeeze it between your finger and thumb; if it contains any considerable quantity of grease, enough will be pressed out to judge of colour, hardness, and sweetness; if the nut tastes oily, and yet oil does not come out by this treatment, it is well to dry the kernel before squeezing; and, in the case of nuts containing grease solid at a high temperature, it is well also to previously heat the nut. When a stearic candle can be got, burn it down a little until it has formed a cup, then blow it out, place into this a little of the material to be tried; after a moment's burning, the candle material with which the wick is saturated is burnt out, the new material to be tried in the cup takes its place, and becomes the material supplying the wick until the cup is emptied, and so can be judged of. The candle on the table, you see, is burning well; the small quantity of linseed oil I now drop in the cup at once makes it smoke, or a piece of string dipped in the oil or melted grease makes a very tolerable wick, or, simpler still, where the nut is very full of oil, if lighted at one end, it will at least show what tendency to smoke there is, and the colour of the light.

"Some of the resins ought to come in for candle-making, though I believe that they have never been extensively used, except for the commonest sorts of candles, on account of their giving off so much smoke; but as some descriptions smoke less than others, there is a hope that new ones may be found which smoke still less; these would then be very serviceable for candle-making. The points connected with new greases, &c., that we should be most thankful for information upon, are, the manner of growth, probable expense of collecting, means of transport, and quantity likely to be obtained, with small specimens of the grease, if manufactured, and of the fruit, with both its husk and hard shell, where these exist.

"In order to avoid the delay which has taken place in ascertaining the value of new oil seeds on a commercial scale, the Company has just arranged for a small, complete set of crushing machinery, applicable to the purpose."

I believe that, as yet, we have had the benefit of but a very small number of the oils and fats which will hereafter be brought in in great quantities.

The Russian war is putting the screw on the oil collectors all over the world. It requires time before their efforts tell to any great extent; however, some fats and oils, which used to make their appearance in single tons, now come in in larger quantities, and the importation of the old oils, such as palm and cocoa-nut, is greatly increasing. Some of the useful fats, which are known to be obtainable in very large quantities, like the Bassia butter of Central India, seem almost unaccountably long in coming in in quantity.

Among all the very many specimens of different oils and fats we have experimented upon, with the exception of the three palms, the cocoa-nut, the cahoun, and the palm oil palms, the kernels of which yield oils seemingly identical, every oil and fat seed appears to yield its peculiar oil or butter; the varieties seem endless.

I have now come to the end of the paper. I have endeavoured to show how the object with which we started, the separation of the glycerine, has been attained by successive improvements, which have reduced the sulphuric acid employed from 32 lb. to 6 lb., from 6 lb. to none. It might appear that fat acid improvements were exhausted. I may say, from personal experience, that of each year of the fourteen in which I have been engaged in this work, including the year just past, there seemed a wider future at its end than at its beginning. It causes at once the charm and the care of all chemical manufactures, that from their nature they can have no end; the refuse of one year may be the most valued product of the next; as in all other pursuits, involving researches into the works of God, we see around us wonderful wisdom and order, and variety, and before us a field for man's labour until the end of time.

DISCUSSION.

The Chairman said, he was sure the meeting must have been pleased at the description given them of the various processes used by Price's Company, which had now become one of the institutions of the country. He was sorry, however, to find that there was no "Mr. Price." He had pictured to himself some venerable ancient, fattening on his well acquired gains, and passing a contented old age somewhere about Vauxhall, but it appeared he was only a kind of Mrs. Harris. The more credit, however, was due to Mr. Wilson and his father for the establishment of this important Company. If they allowed him to call their attention to a few facts, they would probably be the better enabled to follow the discussion. All fats were composed essentially of two parts—fatty acids, and a base—as common salt was composed of muriatic acid and soda. Tallow, however, contained three acids, the stearic, margaric, and oleic. Candles were of two descriptions—those containing the glycerine, and those composed of the acids alone. They would observe, from the specimens before them, that the oleine did not give so good a light as the others, whilst at the same time it was liquid, burnt at a reduced temperature, and gave less light. Before the separation of the glycerine, the great object had been to get this liquid out of the ordinary fats, and this had been accomplished by pressure, the candle material being submitted to a moderate heat, so as to liquify the oleine, but not the other constituents. It was afterwards felt that it would be an advantage to get rid of the glycerine, which, in itself, gave but little light, and lowered that produced by the fatty acids. Here they came to observe how tardy they had been at arriving at the simplest method—a fact which was observable in all discoveries in chemistry—or, he might say, in science. It appeared as though the human mind could not compass the simple operations of nature, but must go in a complex manner to arrive at a given point. The truth was, they were in an unknown field, and, not knowing the road through it, they went by zig-zag courses, until, after a tedious exploration, they discovered both ends of the field, and then saw that the direct road across would have been simple and short. In the first instance, to get rid of the glycerine, chemists were compelled to produce a soap by the union of lime, and afterwards to procure the acids by decomposing the soap. Many processes had been applied, and he remembered, in his early days, he considered he had achieved a great triumph when he obtained glycerine out of fat. Indeed it was one of the tests of preparation that used to be set to young chemists. Now Price's Candle Company obtained the required result by simply blowing steam at a high temperature through the fat. The applications to which glycerine might be put were very numerous. They saw it might be used for the preservation of fruits or provisions—it was most valuable for medical purposes—and he might inform the ladies that it was stated to be an admirable cosmetic. It is said to improve the appearance of the skin, and, unlike other cosmetics, it was not deleterious. He had no doubt there were gentlemen present who could give them some valuable information relative to its applications, and he would, in the first instance, call upon Mr. Startin, the surgeon to the Hospital for Diseases of the Skin.

Mr. Startin said that it was about 13 or 14 years since his attention was first directed to the value of glycerine for medical purposes, the more especially with regard to skin diseases, to which he had given his particular attention. He found that it kept moist, and allayed the irritation generally consequent upon skin diseases. Getting on by degrees, he administered it internally in states of the stomach and system where fermenting saccharine matters could not be borne. He used it extensively in lotions and other outward applications, to preserve these remedies from fermenting or spoiling, and to keep them moist upon the skin. It was a capital antiseptic, which, at an early stage of his observations, he discovered accidentally in the preparation of poultices, one of which, on being placed in a cupboard, was found three months afterwards perfectly fresh. Glycerine was also most valuable in the preservation of different things, medicines, extracts, pills, syrups, &c., and in some kinds of food, as in the preparation of bacon and other salt meats. By the addition of 1lb. of glycerine to the usual ingredients used in the salting of one or two cwts. of meat, it would add to its flavour and prevent the meat from hardening or fermenting, so that it would be more agreeable to soldiers, sailors, and others, who had to depend, in a great measure, upon salt meat and fish. He had not yet made it public. He had also mentioned to his friend, Dr. Andrew Smith, of the Army Medical Board, that he had found glycerine the best remedy for frosted limbs. It contained the elements both of a spirit and an oil, and seemed to unite with the skin itself, and render it elastic and capable of resisting low temperatures, which properties would prove of the greatest importance in the treatment of frost-bites. These, and a great number of other uses, he had published in the paper referred to by Mr. Wilson, *Medical Times*, Vol. 21, for the year 1850, where also the manner of using this agent would be found,—which he would only here mention, for the most part requires to be diluted before it is applied for medical purposes.

The Chairman was happy to find the gentleman present who had drawn up the jurors' report on this subject for the Exhibition of 1851. He would be glad to hear any observations relative to it from him.

Mr. Warren De la Rue, F.R.S., did not think he could add much to the lucid explanations of his friend, Mr. George Wilson, and the Chairman. In the Paris Exhibition of 1855 it was extremely flattering to him as an individual to find that all the real improvements since 1851, in this branch of industry, had taken their growth in England. In no instance was it more apparent than in the display of Price and Co. It was true there were in the cases of other manufacturers the results of processes based upon economy. In Mr. Milly's case there were some admirable products from lime saponification, a peculiarity being in the small quantity of lime employed. There were also some good specimens exhibited by Mr. Boyce. Mr. Tighlman had shown how fatty substances might be prepared, and the glycerine set free by distillation, at a high temperature under great pressure, but he believed Mr. Wilson's to be the better plan, viz., by the passing of steam through iron pipes, by which the substance acted upon became super-saturated, and the glycerine was set free without any great amount of pressure. It was gratifying to find that amidst the cry of the decadence of science in England, there was one branch in which the experiments commenced in France had been improved upon in this country, and the result carried out so as to produce a splendid commercial prosperity. And this instance might be cited as a set off against other cases in which we were falling behind our neighbours. It was gratifying to find that Englishmen were not the only parties who gave short measures. This was one of the natural consequences of the desire for cheapness. Mr. Wilson had briefly alluded to the unfortunate circumstances relative to the great gold medal of honour. It was the unanimous opinion of the English jury that it was due to Mr. Wilson. It appeared that the directors of the Exhibition had formed two peculiar views with regard to those medals, one being that the scientific man who first started the idea of an invention or improvement in manufacture, or by discoveries in science, laid the foundation for it, should be entitled to the medal, even though he was not an exhibitor. On this principle their own countryman, Faraday, obtained a high rank in the Legion of Honour, though it had not pleased our rulers to recognise in England the honour justly given to him by France. As it was, Messrs. Price and Co. must be content with the lustre cast upon them through M. Chevreul's medal, and the knowledge of the high position they had attained. He believed that glycerine was destined to play a most important part, both in medicine and in the arts, and it was due to Mr. Wilson to state, that fine glycerine had never been commercially obtained until produced in his manufactory. Though Mr. Startin might fairly claim the merit attached to the application of glycerine in the cure of skin diseases, he must be allowed to claim for his father the merit of having first suggested its use, at the time when Mr. Hennell was at Apothecaries' Hall.

Mr. **Startin** had forgotten to mention in his observations that he was so indebted, though it gave him great pleasure to acknowledge it.

The **Chairman** asked whether Mr. De la Rue was aware that sebacic acid had been produced at a cheap rate by the distillation of castor oil and with potash, and also capryllic alcohol, which was very useful for dissolving varnishes; and, if so, if it had been produced in large quantities; because sebacic acid, which melts at a high temperature, might be usefully employed for mixing with easily fusible fats.

Mr. **De la Rue** was aware that such products had been exhibited at Paris last year, and though they had been produced in comparatively large quantities, they had not yet been manufactured on such a scale as would extend their uses.

The **Chairman** observed an allusion in the paper to his old friend, Colonel Sir Charles Shaw, as to arrangements made through his suggestion for the benefit of the army, and he should be glad to hear any remarks from the gallant officer.

Col. Sir **Charles Shaw** felt it would be somewhat difficult for him to speak to men without arms in their hands, and if, therefore, he made any mistakes, they must excuse him. Before he had the honour of knowing Mr. Wilson, his attention had been called to Price's candle lamps. It occurred to him that what was good for the officers would be good for the men. He then went to all the shops where he saw supplies for the Crimea, and the first thing he saw was a large japanned case, formed like a knapsack. He tried to put it on, but he was told it was not intended to be so worn, but to keep the clothes in. He replied that it was the internals that wanted most looking to, and if men were well fed they were like cats, who were said to have nine lives. He next found out that the average weight now carried by the soldiers was much below that which they carried in the war in the Peninsula. He next gave Mr. Wilson an idea of what would be of service to the soldier, and he was yesterday called upon to inspect what he believed would save the lives of thousands of soldiers and millions of money to the country. He saw 150 pints of water boiled by a portable fuel, the carrying of which would add very little to the weight already carried by the soldier. If last winter they could have obtained for their army sufficient fuel, it would have saved 20,000 men from dying, and £3,000,000 of money. He was obliged to take into consideration the money value of the lives of their soldiers. There would not have been one-fiftieth part of the sickness in the army last winter but for the want of fuel; and he believed that if the troops were ordered to march from their present quarters, they would be in as bad a position as ever, and the same miseries would be experienced. This, however, could be remedied by the aid of Mr. Wilson's fuel, and that at no great expense. A regiment was composed of 10 companies, each consisting of 100 men, and he looked upon the money value of each soldier as £200. After a few days' march, 1,000 men would be generally reduced to 600, owing to their straggling to obtain fuel to cook their food. Some people had an idea that soldiers died from shot and wounds. It was not so. Col. Leech, in his book on the last war, said, that whereas 40,000 men were killed on the field of battle, or died of their wounds, 120,000 died from disease, and an additional 120,000 were disabled by illness. In the navy, during the same war, 6,000 men were shot, 13,000 died from their wounds, and 72,000 by disease. He wanted to know what was the use of the Minié to men without food—and what was the use of food without fuel to cook it. Now 14 lbs. of Mr. Wilson's candles would cook for 100 men for more than a fortnight, and would not cost one-third the price of ordinary fuel. In Russia, during the last fourteen years, more than 2,000,000 of men passed through the hospital; but they did not know how many came out. A few years since he had the command of a brigade of 1,500 men of the Spanish legion. Upon halting at the conclusion of a day's march, his number was reduced by stragglers to 1,100. He refused to sign for rations for more than were with him. There was nearly a mutiny; but he was firm, and when the stragglers came up, they were fed by their comrades. The next day the stragglers were reduced to 200, who expected to be fed by their comrades; but in a few days there were none at all. They had heard a great deal about the habits of soldiers, and the plunder at Kertch. Why that plunder was only to obtain fuel to cook their victuals. In Oporto libraries were burned for the same purpose; and the greater opportunity they gave the soldier of cooking his food, the more would he be improved. If they observed the French soldier, they would notice the *marmite* at the top of his knapsack, and a faggot of wood—that was to enable him readily to cook his food; but though this provision was made, the French soldier was not otherwise well provided. It had been said that we, as a nation, were slow to adopt novelties. This was no doubt true to a certain extent; but when once we were convinced of the advantages to be derived from any particular invention, it received greater development and encouragement here than elsewhere. As an illustration, he might mention, that though the Minié was a French invention, and was perhaps long in being adopted in our service, yet the British army in the East, though not half as strong as the French, had yet more than double the number of Miniés. The best mode of improving the *morals* of the soldier was to take away from him the temptation to plunder. If a soldier was obliged to look for fuel before he could get his breakfast, he would tear down a door, or anything that came in his way. Before he had the pleasure of knowing Mr. Wilson, he saw a pamphlet relative to the plans of education adopted in his factory, and he sent it out to some of his brother officers, recommending them to introduce it into the army. Soldiers could only be made by labour and experience; and the present mode of making them was a good example of the simile of their Chairman,—they would go round a circle instead of looking for the most direct and simple road.

The **Chairman** was tempted to mention an invention he had seen at Paris for cooking by friction. It was by a wooden cylinder, revolving inside a metal one, by which sufficient heat was engendered to boil water, and perform other cooking operations without fire. Now, although as a source of power this was unphilosophical, yet as a convenient means of producing heat, under certain circumstances, it might be useful.

Dr. Stenhouse, of Bartholomew's hospital, being called upon, said, he could express the great gratification with which he had heard the paper. It was most satisfactory and lucid—its great merit consisting in its freedom from anything like exaggeration. Indeed all the statements made that evening had been extremely moderate—and the advantages gained had been rather under than overstated.

The Chairman said, as they had heard a great deal about the application of fat, he thought they might like to hear something about producing it, and he would call upon Mr. Mechi, as a practical agriculturist, for his opinion on the subject.

Mr. Mechi said that, to obtain fat, the cattle must have plenty of heat. If they wanted to increase the weight of their cattle, they must not throw the heat to the winds. Practically it was a serious question for the farmer how best to improve his cattle. They were, no doubt, well aware that linseed and other oils were extensively used as oil cake to fatten cattle. Cotton oil—oil compressed from the seeds of cotton—had been lately introduced with success, and there could be no question of the value of anything which would tend to cheapen food. He wished the learned chairman would turn his attention to rendering their straw valuable as a fattening agent.

The Chairman—It does not contain sufficient hydrogen.

Mr. Mechi—That was just what was wanted, for it contained plenty of carbon.

Mr. Varley observed, that this evening witnessed the consummation of an early idea of the Society, for members would find, in the Transactions some forty years back, that for several successive years the gold medal and £50 were offered "to the person who should discover to the Society a method of hardening or otherwise preparing tallow, so that candles made be made of it which will burn as clear, and with as small a wick, as wax-candles, without running, and may be afforded at a less expense than any at present made with spermaceti."

A vote of thanks was then given to Mr. Wilson for his valuable paper.

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 30th inst., was "On Cultivation by Steam; its Past History and Probable Prospects," by Mr. John Fowler, jun. (of Bristol). On this evening Mr. J. Allen Ransome will preside.

Home Correspondence.

OBSERVATIONS BY MR. ATHERTON ON THE TONNAGE REGISTRATION DISCUSSION.

Woolwich, Jan. 17th, 1856.

Sir,—With reference to the discussion at the Society of Arts' meeting of the 16th inst. on my paper "On Tonnage Registration," I think it right to take this opportunity of explaining the few points on which my opinions, as intended to be expressed in the paper read by me, do not appear to have been correctly understood by the gentlemen who addressed the meeting. Mr. Moorsom (Inspector-General for Tonnage to the Board of Customs) is officially in a special position on this question, and his having favoured the meeting with any remarks is a concession on his part. The written communication, however, which Mr. Moorsom has made induces me to observe that my paper, though designated by Mr. Moorsom as a "condemnatory harangue," was not dictated by any feeling of groundless opposition either towards institutions, parties, or individuals, but, on the contrary, with a desire to expound the technicalities, and to reason upon the merits of this public question, and to elucidate what I conceive to be the *deficiencies* of the present system of registration as prescribed by the Merchant Shipping Act of 1854. Although, as before stated, I may not, in deference to Mr. Moorsom's official position, expect him to discuss the various points of the tonnage question, such, for example, as the desirableness of recording the capability of ships for carrying *weight* cargo as distinguished from cargo *roomage*, which is one of the deficiencies of the present law, still, I would observe, that the evidence which Mr. Moorsom adduces as being conclusive proof of the efficiency of the present law, viz., the approval of "shipbuilders, shipowners, and the highest authorities connected with maritime affairs," is evidence which I do not recognise as binding on any man who undertakes to exercise his own individual and independent judgment. It is my assertion of the *deficiencies* of our present registration which appears to constitute the objectionable peculiarity of my views on this subject. I do not consider the tonnage question to be disposed of merely because a certain method of correctly measuring a ship has been devised and legalised. Mere measurement is a matter of labour at 7s. 6d. a day, based on mathematical routine, capable of being done in a variety of ways, and I do not agree with Mr. Moorsom in regarding it as a matter of congratulation, or at all complimentary to the science of Britain, that two *legalised* methods of measuring the same ship or ships, namely, the law of 1834 and the law of 1854, should differ, as quoted by Mr. Moorsom, 7 per cent. from each other. The discrepancy of 7 per cent. indicates a process not worthy of being called measurement; has there not been bungling somewhere in this comparative measurement under the law of 1834 and the law of 1854. Mr. Moorsom appears to have rather a confused idea of my views, when he says, "Mr. Atherton would have preferred the divisor of 40 to that of 100 as the factor for tonnage measurement." I beg to explain that for expressing the *fiscal* measurement of ships, I prefer that the product of length, breadth, and depth, taken in feet be divided by 100, because, for this purpose, the divisor 100 would, I believe, give an aggregate nominal result closely in accordance with the past conventional measurement of fiscal nominal tonnage; but for expressing the cargo *roomage* of a ship, I prefer that the available internal cubature, taken in cubic feet, be divided by 40, because 40 feet, and not 100, is the ordinary conventional allowance of *goods* measurement per nominal ton; and since these distinctions do not appear to have been noticed by Mr. Moorsom, I will further explain, that for the reduction of the displacement between the light and load draught water-lines to represent the *cargo* tonnage, I prefer the divisor 35 in preference either to 100 or to 40, because 35 cubic feet of ordinary sea-water weighs one ton. Reason, not caprice, must fix our divisors.

Mr. Moorsom, or the authorities to whom he defers, have, I am happy to find, now conceded that, in addition to the present registration, it will be commercially convenient to register cargo roomage at the rate of 40 feet to the ton, which important concession redeems my harangue from being *unjustly* condemnatory of the present law; and it is to be hoped that Mr. Moorsom and the authorities on tonnage, to whom he defers, may yet be induced to approve of cargo tonnage, based on the measurement of the displacement between the light and load water-lines, at the rate of 35 cubic feet to the ton weight, being also embraced in our future tonnage registration. If these principal objects of useful registration, in addition to the present law, be conceded, I may, perhaps, still offer my opinion on the 7s. 6d. a day measurement question, but I would willingly leave this to any competent shipwright's clerk, and if taking off the lines of the ship be not objected to, I would expect this work (if done agreeably to Peake's rules, which cost 2s.) to be done within 2½ per cent. of precision, and within 5 per cent. if the taking off the lines of the ship be objected to, and the approximate result be based on length, breadth, and depth, as proposed by my paper, in accordance with the principle of the French tonnage measurement. I beg to remind Mr. Moorsom that all the points now brought forward in my paper were duly communicated, and might have been discussed and settled while the bill of 1854 was in abeyance, before it became law, which somewhat mitigates the imputed "*illiberality*" of the present "*agitation*," and as to delaying this agitation (to which term I have no objection, provided it be not qualified as illiberal) I may observe that errors or deficiencies in legislation are difficult to correct if they once become quietly accepted as the law of the land. The sooner, therefore, the Merchant Shipping Law of 1854 is agitated and made fully effective for the useful purposes, both commercial and scientific, of tonnage registration, the easier it will be to introduce the amendments necessary for effecting that object.

Mr. Scott Russell's remarks appear to me to be a liberal exposition of the subject, disinterested and based on principle. His only misapprehension of my paper was that I advocated the substitution of either cargo tonnage or roomage tonnage in *lieu* of the present fiscal tonnage registration. This is a mistake on Mr. Scott Russell's part; I advocate the registration of the capability of ships for *weight* tonnage and for *roomage* tonnage, in *addition* to, not in substitution of, the fiscal measurement tonnage, which latter measurement ought, in my opinion, to be based on length, breadth, and depth, (as by the French law of tonnage admeasurment,) divided by such factor as would least derange the progressive ratio of our national tonnage registration, and, if so thought fit, be subject to such discriminations as may be judged to be necessary in respect of steam-ships. I thank Mr. Scott Russell for the admission that as a shipbuilder he would be *pleased*, and as a scientific man he would be *delighted*, to see the tonnage amendments suggested by my paper carried into effect.

Mr. Andrew Henderson's views appear to coincide with my own as to the objects which it is desirable that registration should embrace; but as regards the mode of effecting these objects, Mr. Henderson is the advocate of certain plans differing from mine, and which, therefore, will render more complete and comprehensive the choice of systems that will be submitted for the consideration of the Committee of the British Association, of which Mr. Henderson is a member. From Mr. Henderson's remarks, it appears that the local measurers of shipping for registration under the new law do not complete the calculation of tonnage, but merely fill up the printed formula of dimensions, which is forwarded to London for the completion of the calculations at the office of the Inspector-General; which confirms my statement that the present system of tonnage measurement and computation is not satisfactorily adapted for general mercantile convenience. It seems now to be almost impossible for a merchant himself, as heretofore, to calculate the tonnage of an intended ship, and thus conclude his bargain with a builder, without in the first place taking for granted the builder's computation, and ultimately, after the ship is built, calling in the aid of custom-house officers to measure, and of the Inspector-General for tonnage to compute, the tonnage of the ship; whereas, if the rule for builders' measurement were,—"Take the product of length and breadth, and *depth of hold* in feet, and divide by 100,"—the chief cause of the anomalies under the old rule of builders' measurement, which has been the base of building contracts since 1720, would be done away, and any merchant would be able, by one minute's calculation, to ascertain for himself, more correctly than heretofore, the nominal tonnage of his contemplated ship, leaving only the completion of the tonnage record, as to cargo tonnage and cargo roomage, to be taken from the ship when built and measured for registration.

Mr. Mitchell's remarks (resulting, no doubt, from a cursory perusal only of the proof-sheet, which had been previously distributed widely for the information of gentlemen likely to take an interest in the discussion) very appropriately call attention to two most important points, namely, whether my paper is characterised by fairness of statement as respects the sentiments and action of the Shipping Interests on the question of tonnage registration, and the supervision of shipping under the "Merchant Shipping Bill of 1854." Now, first of all, can it be said that there is any sentence in my paper unbecoming, and not fairly within the bounds of argumentative propriety in any remark of mine on this occasion. If such be the opinion of the Council of the Society of Arts, or the chairman of the meeting, I regret it, and I claim the privilege of retracting it. "Illiberality" will not aid my cause,—but what are the facts? I speak of "commercial cleverness;" surely, there can be nothing inappropriate in that term as applied to the Shipping Interests. Also, in the course of my argument, and referring to historical events connected with the House of Commons, the Reform Bill, the Free Trade movement, Joint Stock affairs, and the proceedings of corporate bodies in the professions of Law, Physic, and even of Divinity, I conclude with the following inferential remark:—"What right or reason then have we to expect that the shipping interests will voluntarily petition the legislature for an effective system of registration, throwing open the *mysteries of their craft* with a view to public good?" Such is the context of the phrase objected to by Mr. Mitchell. I apply the phrase "*mysteries of their craft*" in the sense and signification in which the phrase is known to every guild in London.

Having thus explained the phrase "mysteries of their craft," with reference to the context in which it is used by me, I may not necessarily be answerable for the inferential context in which Mr. Mitchell is pleased to place that phrase. Nevertheless, I will not decline Mr. Mitchell's invitation. Admissibly the tacit sense of my paper is, that the shipping interests are a class of business men, honest *as times go*, but certainly not purists, and the substance of my argument is, that by the adduced standards of public morality of the present time, we have no right to expect that they should be so. Does Mr. Mitchell mean to affirm that my argument is not fair towards Shipowners, for that they are purists, sighing for the public good. If so, then let us by all means worship shipowners as a class; let us go on wrecking *well-insured* ships at the rate of 1,799 ships per annum, take no official record of their *draught* on leaving port with reference to any regulation *limit*, and let us have no amendment of our Merchant Shipping Bill, because a bench of paragon Shipowners, Heaven-born millionaires, are causing the printing press to overflow with their ecstacy, in approbation of the restricted registration prescribed by the Merchant Shipping Law of 1854 as it now stands. I would, however, observe, without at all attributing fault, that I have almost invariably found insuperable difficulty in obtaining from steam-shipping agents those details of statistics which I have sought for in connection with displacements, and which I conceive to be necessary, conjointly with other data, for determining the comparative merits and value of steam-ships as locomotive machines, which data are not included in the present official registration.

I impute to the shipping interests no unworthy motive for declining to concede voluntarily such information; they have a right to refuse it if they please. The question is, whether official registration, in the cause of public good, ought not to exact the statistics referred to. As to Mr. Mitchell not being able to follow out my views to their conclusion, and desiring further information thereon—if Mr. Mitchell is really desirous to "discover in what way the rate of income-tax and the price of bread may be affected by shipping statistics," I would recommend him to make himself master of Atherton's Essay on "Steamship Capability," 2nd edit., published by Weale. Mr. Mitchell will then, I think, admit, that profligate Utopian ideas have prevailed, in regard to the capabilities of steam-ships for goods conveyance, per ton weight, at high speed, on long voyages, without re-coaling, and that the consequences of such errors, if not exposed, might involve useless churning of the sea at such pecuniary cost as would nationally affect the rate of income-tax in time of war, and the price of bread as dependent on freight in time of peace, and that statistical registration, of a description which the Merchant Shipping Bill does not at present include, is essential to science for the exposition of such profligacy. Looking back, therefore, to what we have seen in connection with steam-shipping projects during the past two years, and the state of public delusion in regard thereto, I maintain that there is nothing figurative in my expression, that "the rate of income tax and the price of bread" may be affected, and seriously so too, as a consequence of the prevalence of such errors not being exposed, for want of the statistical data which tonnage registration ought to supply, but does not.

Steam-ship capability, as affecting the cost of freight, is quite a new study, and the sooner it is attended to by the public the better it will be for the cause of public good, especially now that British shipping is thrown open to the competition of the whole world.

We now come to the point whether or not my paper is characterised by unfairness of statement as respects the official supervision of shipping, with a view to the prevention of shipwreck. The fourth division of my inquiry into the deficiencies of the present registration refers to this point. My leading remark is as follows:—"It will not, I presume, be doubted that the too deep loading of ships constitutes one of the greatest sources of danger to which a ship can be exposed," and after remarking on the details of railway supervision, I conclude as follows:—"How strangely does this scrutinising supervision over railways contrast with the fact that the *deep draught* of a ship, on which safety at sea so much depends, is left to the caprice of parties whose pecuniary interest consists in loading a ship to the uttermost, no record being taken thereof when a vessel leaves port, and no means of proof available for judicial inquiry in the case of a ship foundering at sea with 500 souls on board." The too deep loading of ships was the source of danger thus especially brought forward by me. I submit that the investigations which I adduced substantiated my remarks as to the liability of ships being overloaded, and as neither the records of the registration, nor the specific terms of the merchant shipping act, appear to touch upon this perhaps the greatest of all sources of danger to which a ship can be exposed, it appears to me quite fair that I should avail myself of this argument touching humanity as an additional reason for introducing the registration of cargo tonnage, based on some regulation *limit* as to the deep draught water line of a ship; but having thus limited my arguments to the consideration of safety as dependent on restricting the load line within some regulation limit, it is not quite fair to expect that I should go into numerous details that have no connection with matters embraced in my paper, but, nevertheless, being rather jealous on the imputation of "unfairness" and "illiberality," I will, for the satisfaction of Mr. Mitchell, refer to "the very heavy penalties liable to be inflicted on the shipowner under the Merchant Shipping Bill of 1854 in the event of loss of life at sea," in *proved cases* of violation of the requirements of the Merchant Shipping Act of 1854.

In the matter of boats and life-buoys.—"If the owner be in fault he shall incur a penalty *not exceeding* £100, and if the master a penalty *not exceeding* £50."

In the matter of lights and fog signals.—"The master or owner if in fault shall incur a penalty *not exceeding* £20."

In the matter of the build of iron steam-ships.—"If not built and divided into compartments agreeably to the requirements of the Act, the owner shall incur a penalty *not exceeding* £100."

In the matter of details of equipment.—"If the owner be in fault a penalty *not exceeding* £100, and if the master be in fault a penalty *not exceeding* £50."

In the matter of obstructing surveyors.—"A penalty *not exceeding* £5."

The above specimens of "stringent provisions and heavy penalties," to which the shipping interests may be liable in the event of loss of life at sea, attributable to neglect in the matters referred to, are quoted in deference to Mr. Mitchell's remarks, "that it was proper the public should know that they were thus cared for and protected when travelling in British ships." From the above so-called "heavy penalties," we must deduct the attendant saving that would be effected by the non-fulfilment of the requirements of the Act in the various matters above referred to; the *balance* will show the loss or profit, as may be, that would be incurred by violating the Act, death ensuing in consequence, and the penalty paid accordingly. The striking of this balance is a mercantile, not a professional consideration. I will only further observe, that in these demonstrations of solicitude for the protection of the public, the Shipping Interests have not omitted, like business men, to care for themselves, by causing it to be embodied in the Act, in each and every case, that the above heavy penalties shall *not be exceeded*.

I agree with Mr. Mitchell—let the public have the Truth, by all means.

Now, seriously, are not these penalties a farce?

Mr. Mitchell will, perhaps, take the pains to ascertain the sum total of penalties exacted and the causes thereof, in connection with the 1799 cases of shipwreck, stated in the *Shipping Gazette* to have occurred during the year 1855.

With these remarks on the discussion, I now leave this registration question in the hands of the Council of the Society of Arts, hoping that they will recommend it for the consideration of the Committee of the British Association, conjointly with the other submissions that may be brought before the Committee, and that the labours of the Committee may result in measures conducive to the Public Good.

I am, Sir, your obedient servant,

CHAS. ATHERTON.

REMARKS ON MR. BLACKWELL'S PAPER, ON "THE PRESENT POSITION OF THE IRON INDUSTRY OF GREAT BRITAIN, WITH REFERENCE TO THAT OF OTHER COUNTRIES."

Sir,—In the year 1852, Mr. S. H. Blackwell, F.G.S., delivered a Lecture before the Society of Arts, Manufactures and Commerce, "On the Iron-making Resources of the United Kingdom," it being one of a series of lectures" on the "Results of the Great Exhibition of 1851," delivered at the suggestion of H.R.H. Prince Albert, President of the Society. It is admirable in its details throughout; it bears altogether on the subject matter of its title, and besides going fully into the resources of this kingdom, touches upon those of the United States of America, and draws attention to the improvement in the manufacture of iron which is taking place in other countries. During the last year a paper was read by Professor John Wilson, F.R.S.E., "On the Iron Industry of the United States;" also, one by Mr. Charles Sanderson, "On the Manufacture of Steel, as carried on in this and other Countries;" and there was likewise a paper read by Mr. Robert Hunt, F.R.S., Keeper of Mining Records, "On the Mineral Industries of Great Britain." These interesting and valuable papers all bear upon the subject, and afford preliminary matter to the paper read before your Society, at two of your meetings, on the 19th December and 9th January last, by Mr. J. Kenyon Blackwell, F.G.S., "On the Present Position of the Iron Industry of Great Britain, with Reference to that of other Countries," a subject of vast importance in itself, and bearing upon all the important interests of the country. In this latter paper Mr. Blackwell stated that the annual production of pig or crude iron appeared, from a careful comparison of various authorities, to be at the present period nearly 6,000,000 tons per annum, of which 3,000,000 tons are placed to Great Britain, and an equal quantity to the rest of the world. This, I must say, appears to me to be almost the only point bearing on the object of the Society. How far the subject might have been worked out in two more meetings, whic the chairman declared would be necessary if Mr. Blackwell (who) "had gone very fully into the geographical, geological, and chemical parts of the question," "had entered fully in the manufacturing and commercial parts," may be judged from the talent displayed; but the parts omitted, concisely and clearly brought before the meeting, are the facts which really constitute the value, in a practical point of view, of the subject itself. Of the value of the paper *per se* it will not be necessary to speak further than, as I conceive, it leaves "the present position of the Iron Industry of Great Britain with reference to that of other countries," almost untouched in, if you please, "a commercial point of view." This may be now considered an open subject, but one so important in itself, that it may still with great advantage be committed to the hands of those who have the opportunities and requisite knowledge to bring it before your Society and the intelligent public.

In reading the discussion which took place upon the paper, I was strongly impressed with the use of the suggestion I made in some letters I wrote in your *Journal* last year, "On the Statistics of the Iron Manufacture." My suggestion was not met in any way further than by one letter of approval, from Mr. Thomas M. Gladstone. But, nevertheless, such information would regularly supply that want which the very title of the paper read offers for our consideration. With respect to Professor Wilson's paper "On the Iron Industry of the United States," it was, I think, wanting in particulars which might have been a useful guide to our manufacturers, he having peculiar advantages for obtaining information with regard to detail of cost and transit. American Statistical Societies give this information. Again, in France, the Minister of Commerce was good enough, a short time back, to send me at my request, a copy of his report, "Des Travaux Statistiques de l'Administration des Mines in 1847, 1848, 1849, 1850, 1851, and 1852." This work contains an immense and valuable mass of information bearing on all points connected with the manufacture of iron. In this we are deficient from the apathy of the ironmasters, and more particularly that of the parties interested in the consumption, for it is the public who are really most concerned in the question. The ironmasters satisfy themselves with their iron make; they push for quantity, sell it, and care no more about it. With respect to the remarks made by Mr. Blackwell, on the contributions of the iron manufacture to the Paris Exhibition, that "the quality of the iron exhibited was not shown in any conclusive or advantageous manner, nor were there any specimens displayed proving the application of greater or even of equal mechanical power in the working of iron in this country as compared with others," I cannot say how this might be, not having been present at the Exhibition, but I must say that generally, the quality of the iron in this country is not sufficiently considered, and an observation of Mr. Anderson's will tend to show that if the ironmasters are not very particular in their make, it arises in some measure from their not being looked after:—"In the position which he (Mr. Anderson) occupied, where the quality of iron was the chief object, and from having ample opportunity of knowing how little was done to improve the quality of our material, not only by the ironmasters who make it, *but also by the engineers who use it*, he felt at no loss for the cause of this lamentable condition." I do not hesitate to say that if *quality* were a consideration with buyers, the whole make of Blaenavon iron would always be sold in advance, but this encouragement is not afforded. But when masses of rails, 80 feet long, which prevented any examination of the quality of the smaller specimens of iron, were exhibited (as mentioned by Mr. Blackwell in his concluding remarks), it must pretty clearly have proved to those acquainted with the power of the machinery necessary to turn out a sound and well-finished rail of such a length, that the machinery must have been of considerable power, and so far, more than equal to the usual requirements. Mention is also made of cast-iron pipes "six feet diameter, but England had none there." This is a decided and important improvement in the manufactures of France. The foundry has long existed in this country without a rival, except for the smaller kinds of castings. "Ship-building and the casting of iron cannon" are mentioned, as the sole manufactures in which the English excelled in the reign of James 1st, and it is noticed in "Macpherson's Annals of Commerce," "that in 1788 orders were sent from Paris to Mr. Wilkinson (a gentleman of great eminence in the iron manufacture) for iron pipes, to the extent of no less than forty miles, to be used in supplying that capital with water." I think, however, iron pipes of any diameter would have been out of place in the English department. On the quays of Liverpool any quantity of iron pipes, somewhere about five feet in diameter, might lately have been seen, for the supply of that town with water, but there could be hardly a limit to any required size.

A correspondence in the *Mining Journal*, between Mr. Truran, the author of a new work on "The Iron Manufacture of Great Britain," and Dr. Henry M. Noad, who signs himself "Consulting Chemist at the Cwm Celyn and Blaina Works," would lead us to suppose that, at any rate, the quality of the iron at those works is attended to. Some of the great ironmasters might smile at the idea of such an officer appended to their works, but there are others who must think differently, or such an appointment would not have been made. The important point elicited in this correspondence is, that a furnace at those works occasionally makes 250 tons a week, and its usual weekly average is from 220 to 240 tons (equal nearly to a week's work of England and Wales in 1740), a make stated to be suitable for "railway bars, that may challenge competition with any made at Dowlais or elsewhere."

No doubt a great deal has been done in this country of late years to increase the strength of cast-iron. At the time when railways were first coming into active operation (about 1836), the cast-iron chairs were so weak, (the rail itself, the fish-bellied and others being about 35lbs. per yard), that there were constant complaints of the probable danger as well as positive loss from the vast quantities which were broken. With a view to obviate this evil, I took out a patent for malleable iron chairs, but I, like other patentees, had only loss from my invention. The increased weight of the rails, the improvement in strength, in the cast-iron, from the mixture of metals, and the disinclination of the ironmasters to carry it out, as every engineer, in those days, had a fancy of his own, it was considered that the expense would be too great to suit every new rail with an expensive set of rolls, besides which, and the more important fact with regard to the make was, that the cast-iron chairs would yield a more ready profit. I corresponded with the late Mr. George Stephenson and other eminent engineers on the subject. They all approved highly of the suggestion, but the means of supply were not afforded. I had not the opportunity of making them myself in any quantity—but, (besides some chairs for contractors' rails) I rolled about 50 tons for the Earl of Durham, and some time afterwards, being at his colliery, I spoke to the engineer about them, and he said he wished that they had been laid down throughout the whole of the lines, as they had never moved or required removal. This patent, although of no further use to me, may still, I think, be used to great advantage. The rails are now generally uniform in shape, and these chairs can be rolled without difficult to any size, and are easily cut with the circular saw. Foreigners, in particular, might do well to consider this, especially where they have not facilities for re-casting broken cast-iron chairs.

In conclusion, I beg respectfully to suggest to the Council the titles of two papers on the Iron Manufacture, which I conceive likely to afford very valuable information, and admit of equally valuable discussion:—

First. The manufacture of iron with reference to the use of the hot and cold blast—and also, as to the waste of fuel by the present system of calcining the blackband iron-stone.

Second. The present position of the Iron Industry of Great Britain, with reference to that of other Countries, as regards the cost of production and transit.

It was well observed by a French writer some time back, that "Ce que l'on nomme en France la question du prix des fers, est, à proprement parler, la question du prix des bois, et la question *des communications interieures par les routes, fleuves, rivières et canaux*."—Yours faithfully,

HARRY SCRIVENOR.

Ramsey, Isle of Man,
Jan. 17th, 1856.

THE SURGICAL INSTRUMENT IN THE PARIS EXHIBITION.

62, Strand, Jan. 23, 1856.

SIR,—In the discussion upon Mr. Blackwell's paper on the Iron Trade, Mr. Kennard said, that at the Great Exhibition the French had surgical instruments which for finish and workmanship surpassed our own.

Now this was not the case; our instruments were equally well-finished and better made than theirs, and of this the French jurors were perfectly aware, for they distinctly refused to examine any instrument for its workmanship only; all they wanted was "novelty," and it was in consequence of this evident partisanship and the urgent *personal* solicitations of one of the French exhibitors, backed by the two jurors, his countrymen, for a higher class medal than was designed to be given, that decided the English instrument-makers not to exhibit in the French Exposition.—I am, Sir, your obedient servant,

R. WILLIAMS.

Proceedings of Institutions.

◆

LIMERICK.—The first general meeting of the members of the Athenæum was held on the 3rd inst. On this occasion the new lecture-hall was opened. It is of noble proportions, simple in design, and is said to be one of the finest halls for its special purposes in Ireland. The meeting was held in the apartment devoted to the agricultural club, and the chair was occupied by Alderman JOYNT. The secretary, Mr. FITZ GERALD, having been called on by the chairman, proceeded to read the minutes, the report of the Council for the past year, and the laws of the association. When the Report, which referred to the exertions of the committee to secure the present site, the selection of plans, the collection of subscriptions, the labours of the past year, was read, the Rev. JOHN BRAHAN proposed and Mr. ALEXANDER seconded, that the report be adopted and published. The SECRETARY then read the account of the receipts and expenditure, which was likewise ordered to be published. The laws of the Society were again read, and after some discussion were amended.—The CHAIRMAN then stated that the foundation of a Free Public Library in Limerick would confer lasting advantages on the citizens, and he hoped the members would not separate without passing a resolution which he had prepared, to the effect that, inasmuch as a free public library would benefit all classes, but especially those who could not buy or procure books, and as the establishment of a free library would be sure to lead to donations of books and money, it be an instruction to the Council of the Athenæum to give the project all the aid in its power.—The Rev. JOHN BRAHAN and Mr. J. T. SEYMOUR agreeing most cordially with the chairman's suggestion, proposed and seconded the resolution, which was carried.—Mr. ALEXANDER next proposed a resolution, directing the Council to summon a meeting of the friends of agriculture in the county and city, in order to establish a Farmers' Club, to have lectures on agricultural science delivered in the lecture-hall, and to have the club-room comfortably fitted up for the use of the members, and supplied with books and periodicals.—Mr. MILLINGTON seconded the resolution, which was then put and carried.—Samuel Alexander, George Westropp, and Wm. Fitzgerald were re-elected trustees of the Athenæum.—The CHAIRMAN then stated that from the beginning the undertaking had had to labour with many difficulties, but the generosity of the citizens had enabled them to overcome them all. The objects were such as commended themselves to every citizen and friend of Limerick. To elevate and refine the minds of all—to place within the reach of the humblest as well as the highest the means of intellectual training and discipline—to secure one spot in Limerick, far removed above the noise of political discussion or religious strife; these were some of the objects they were striving to attain.—The ballot for members having taken place, the following Council, which represents all classes and parties in the city, was elected:—Alderman Joynt, Thomas Fitt, Samuel Alexander, Rev. John Braban, Dr. Evans, Wm. Fitzgerald, Dr. Griffin, Robert Hunt, J. T. Mac Sheehy, Dr. Kane, John M'Kern, Henry O'Shea Richard Russell, James Barry, J. P., Revs. Wm. Tarbotton, George Westropp, Archdeacon Keating.—The Mayor and three members of the corporation are ex-officio members of the Council, and each of the affiliated societies send two deputies to the Council.

ROYSTON.—At the Annual General Meeting of the members of the Mechanics' Institute, held on Monday evening, January 7th, John Fordham, Esq., in the chair, the secretary (Mr. John Warren) read the report. It stated that the total expenditure of the year was £73 12s. 1d.; the total income £73 3s. 5d.:—showing a deficiency of 8s. 8d., which sum had been advanced by the secretary. The number of members and subscribers (including 9 life members) was 248; of these 10 paid 6s., 1 paid 5s., 174 paid 4s., 7 paid 2s. 6d., 47 paid 2s., and 9 had paid a life subscription. The classification of these 248 members presents:—1 local magistrate, 4 ministers of religion, 1 member of the House of Commons, 24 private gentlemen, members of the learned professions, merchants, manufacturers, and architects, 45 tradesmen, &c., 13 farmers, 32 mechanics, shopmen, and town labourers, 106 females, and 22 youths under 18. A subject not less interesting is the *constancy* shown by members in subscribing. Of the 248 members, there were 48 new; 37 had subscribed more than 1 year and less than 3 years; 103 for 3, 4, or 5 years; 51 for more than 5 years, and 9 for life. Ten lectures were delivered during the year, the lecturers being the Rev. W. G. Barrett, Dr. Trevethan Spicer, Messrs. Joseph Fearn, George Barker, W. J. Notley, George Buckland, J. Bennett, and Mrs. Grosvenor. Two of these were for the benefit of the Building Fund, which was enriched in consequence by the sum of £7 6s. 0d. During the past year, 44 vols. were added to the library; of these, 31 were purchased, and 13 were donations. Mr. Isaac Beale, the librarian, has drawn up the following statement:—

Number of members making use of the library during the year	98
Number of evenings for issuing books	51
Number of volumes issued	1477
Ditto ditto renewed	723
Giving a total number of volumes	2200
And an average number for each evening of...	43·14

Eighty-seven members subscribed to the reading-room last year. The room was open 311 evenings; 6055 visits were paid to it; and the average number of members each evening was 19·47. The French classes, conducted so liberally by Mr. F. F. Frechet, were closed in the early part of the year. The report was unanimously adopted, the treasurer's accounts approved, and the committee of 1856 elected. The revised rules recommended by the committee were then read, and, after some discussion as to the alteration of the title of the Institute, were passed almost unanimously. Thanks were then voted to Mr. John Fordham, for his services as secretary of the preliminary savings bank, to Mr. Warren as secretary of the Institute, and to Mr. Isaac Beale as librarian.

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
British Architects, 8, Adjourned Discussion on Mr. C. H. Smith's paper, "Remarks on the Forms, Methods of Casting, and Ringing of Large Bells; with suggestions on the subject."
Entomological, 8, Anniversary.
Geographical, 8½, 1. Copy of a letter from Chief Factor James Anderson to Sir George Simpson, Governor-in-Chief of Rupert Land, dated Fort Resolution, September 17th, 1855; 2. Mr. A. G. Findlay, "On the probable Route of Sir John Franklin's Expedition;" 3. Arctic Discussion, continued from last meeting.

TUES. Royal Institution, 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Discussion upon Mr. Robinson's paper, "On the Past and Present Condition of the River Thames."

WED. London Inst., 3 Mr. Robert Grant, "On Elementary Astronomy."
Society of Arts, 8, Mr. John Fowler, jun., "On Cultivation by Steam; its Past History and Probable Prospects."

THURS. Royal Institution, 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. Grant, "On the Natural History of Extinct Animals."
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.

FRI. Botanical, 8.
Royal Institution, 8½, Prof. Tyndall, "On the Disposition of Force in Paramagnetic and Diamagnetic Bodies."

SAT. Asiatic, 2.
London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January* 18*th*, 1856.]

Dated 16*th November*, 1855.

2584. William Cooke, 49, Frederick-street, Gray's-inn-road—Improved apparatus for cleaning knives and other cutlery.

Dated 21*st November*, 1855.

2624. William Cooke, 49, Frederick-street, Gray's-inn-road—Improvements in gas and solar light reflectors.

Dated 29*th November*, 1855.

2698. George North, Lewisham-road, Greenwich—Improved portable apparatus for supporting and folding heads, tilts, coverings, and awnings of wheel carriages, marine vessels, goods, and ways.

Dated 10*th December*, 1855.

2788. John Hall, jun., Mount Pleasant, Walmersley, near Bury—Improvements in jacquard looms.

Dated 12*th December*, 1855.

2807. Isaac Beardsell, Huddersfield—Improvements in the finishing of mohair cloths and other textile fabrics, and in the machinery employed for that purpose.

2809. Robert Midgley and George Collier, Halifax—Improvements in preparing worsted, mohair, alpaca, cotton, and other yarns.

2811. Richard Holben, Barton, Cambridgeshire—Improvements in apparatus for chapping barley.

Dated 13*th December*, 1855.

2813. John Roberts, Falmouth—Improvements in machinery for moulding bricks and tiles.

2815. Alphonse Louis Poitevin, Paris—Improved photographic printing.

2817. James Murdoch, 7, Staple-inn—A process for separating the oleine from the stearine of fatty and oleaginous bodies, and for the extraction of oil from oleaginous grains and from olives. (A communication.)

2819. John Little, Glasgow—Improvements in heating and cooking apparatus.

1821. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for containing compressed air or gases, and in the application of the same to the obtainment of motive power. (A communication.)

Dated 14*th December*, 1855.

2823. John Walter Friend, Freemantle, Southampton—Improved registering log and deep-sea lead.

2825. Alfred Krupp, Essen, Prussia—Improvements in railway and other wheels, and in the method of, and machinery for, manufacturing the same.

2827. Charles John Todd and Robert Pinkney, Long-acre—A balance pen.

2829. Peter Haworth, Manchester, and Alexander Forrest, Birmingham—An improvement in the manufacture of belts, bands, braces, and other similar articles of wearing apparel.

Dated 15*th December*, 1855.

2831. Leonard Clayton, Unsworth, Lancaster—Improvements in machinery for dressing yarn.

2833. John Aspinall, Limehouse—Improvements in machinery for curing sugar and extracting moisture therefrom, parts of which are applicable to separating liquids and moisture from substances containing the same.

2837. Agnes Wallace and John Wallace, Nether Place Bleach Works, Renfrew, N.B.—Improvements in bleaching, washing, or cleansing textile fabrics and materials.

2839. William Clay, Liverpool—Improvements in the manufacture of bar iron.

2841. William Clay, Liverpool—Improvements in the manufacture of iron and steel.

Dated 17*th December*, 1855.

2843. Samuel Fletcher Cottam, Manchester—Improvements in mules for spinning cotton and other fibrous materials.

2845. Charles Bracegirdle, Congleton—Improvements in the manufacture of bolting cloths employed in dressing flour.

2847. John Lobb Jeffree, Blackwall—Improvements in or additions to furnaces.

2849. Frederick William East, 185, Bermondsey-street—Improvements in water-proofing and enamelling textile and other fabrics, in imitation of and to be used in lieu of leather, and for other similar purposes.

2851. William Sangster, Cheapside—Improvements in the manufacture of stays and corsets.

2853. William Hemsley, Melbourne, Derby—Improvement in the manufacture of elastic pile fabrics.

2855. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in ships' tillers. (A communication.)

2857. William Wilkinson, Nottingham—Improvements in machinery employed in the manufacture of looped fabrics.

Dated 18*th December*, 1855.

2859. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved harvesting machine. (A communication.)

2861. Christopher Nickels, Albany-road, Surrey, and James Hobson, Leicester—Improvements in the manufacture of pile fabrics.

2863. Alfred Vincent Newton, 66, Chancery-lane—Improved mode of manufacturing wrought-iron cannon. (A communication.)

2865. Alfred Vincent Newton, 66, Chancery-lane—Improvements in washing machines. (A communication.)

2867. Frederick Robert Augustus Glover, M.A., Bury-street, Saint James—Improved instrument or apparatus for taking angles, and measuring lines, surfaces, and solids, and ascertaining the variation of the needle.

Dated 19*th December*, 1855.

2869. Joseph Cartwright, Hyde, Chester—Improvements in taps or valves.

2871. Richard Ruston, Birmingham—Improvements in the construction of anchors, and appendages to be used therewith.

2873. Josiah Sanders, Bristol—Improvements in trusses for supporting parts of the human body.

2875. George Harvey, Charlotte-street, Portland-place—Improvements in portfolios.

Dated 20*th December*, 1855.

2877. Robert William Sievier, Upper Holloway—Improvements in guns and pieces of ordnance, and the projectiles thrown from them for the purposes of war.

2879. James Fleming, jun., Newlands-fields, Renfrew, N.B.—Improvements in bleaching, washing, cleansing, and preparing textile fabrics and materials.

2881. Evan Evans, South Wales—Improvements in combining and fixing railway bars.

2883. Philip Antrobus, Chepstow—Improvements in preserving and packing flour.

2885. Alexander Charles Louis Devaux, King William-street—Improved machinery for crushing and grinding vegetable and other substances.

Dated 21*st December*, 1855.

2887. David Dunne Kyle, Albany-street, Regent's-park—A method of communicating motion.

2889. John Watson, Glasgow—Improvements in the manufacture or production of articles of ladies' dress.

2891. Bernard Hughes, Rochester, New York, U.S.—A mode of mingling the vapour of bi-sulphuret of carbon and steam, and applying them as a motive power.

2893. Charles James Appleton, Manchester—Improvements in machinery or apparatus for knitting. (A communication.)

2895. Edward Tyer, Cornhill—Improvements in telegraphing or communicating by means of electricity.

2897. Charles Glover, Lincoln—Removing snow from a line of railways.

Dated 29*th December*, 1855.

2942. Lewis Harrop, Samuel Barlow, and Alexander Boyd, Oldham—Improvements in self-acting mules for spinning and doubling cotton and other fibrous materials.

2944. Alfred Ford, Park-lodge, New-road, Hammersmith—Preparing and dissolving in naptha or oil of turpentine vulcanised india-rubber, for the purpose of waterproofing, and all or any of the other purposes for which the same, not so prepared and dissolved, is now applicable.

2946. William Lange, 56, Tachbrook-street—Improvements in biscuit ovens. (A communication.)

2948. George Royds Birch, Paddington—A form and folding desk combined, adapted for the use of schools.

2950. Thomas Holmes, Hull—Improvement in the manufacture of driving straps or bands for machinery.

Dated 31*st December*, 1855.

2954. Joseph Salter, Manchester—Improvements in apparatus for promoting the draught in chimneys, and for ventilating apartments.
2956. Archibald Turner, Leicester—Improvements in the manufacture of looped fabrics.
2958. George Hallen Cottam, St. Pancras Iron Works, Old St. Pancras-road—Improvements in applying detonating or exploding signals on the rails of railways.

Dated 1*st January*, 1856.

2. Ferdinand Swift, Brompton-row, Brompton—Improvements in carriage wheels and axles, and in vehicles for common roads.
4. Alfred Vincent Newton, 66, Chancery-lane—A novel system of propulsion, applicable to land and water. (A communication.)
6. Alexander Cochrane, 11, Eaton-terrace, St. John's-wood—Improvements in collecting and distributing water and alluvial deposits contained in sewage and other water.

Dated 2*nd January*, 1856.

10. Richard Albert Tilghman, Philadelphia—Improvements in the manufacture of iron.
12. Harvey Lewis Sellars, M.D., and John Littler Talbott, Cincinnati, U.S.—Improved apparatus for measuring and weighing grain, seeds, and other substances. (A communication.)

Dated 3*rd January*, 1856.

14. Frederick Haines, Lime-street, City—The deadening of the sound and the prevention of concussion in connection with machinery, gun and mortar boats, and general ordnance, and other purposes.
16. George Williams, 16, Cannon-street east—Improvements in the construction of water-closets for ships.
18. William Alfred Distin, 31, Cranbourne-street, Leicester-square—Improvements in pipes for smoking.
22. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus or means for facilitating the performance of church and other music on organs, harmoniums, pianos, and other similar keyed musical instruments. (A communication.)
24. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in breech-loading firearms. (A communication.)
26. James Frederick Lackersteen, 7, Young-street, Kensington-square—Improvements in the prevention of collisions on railways.
28. Charles Marsden, Kingsland-road—Improvements in the ventilation of sewers, tunnels, mines, and other confined places.

Dated 4*th January*, 1856.

30. Henry Bach, Sheffield—Improvements in the application of glass to decorative purposes.
32. William Simmons, Oldham—Improved hat body.
34. Thomas Hudson, South Shields—Improvement in furnaces.
36. Edward Hammond Bentall, Heybridge—Improved machinery for pulping turnips and other vegetable matters.
38. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of jacquard piled, or terry fabrics, when parti-coloured yarns are used. (A communication.)
40. Francis William Gerish, East-road, City-road—Improvement in the manufacture of cast hinges.
42. William Oliver Johnston, Broomhill Colliery, Acklington, Northumberland—Improvement in apparatus used for giving notice when the water in a steam boiler is too low.
44. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

Dated 5*th January*, 1856.

46. James Coxeter, 22, Grafton-street-east—Improvement in an apparatus for generating steam for medical and other purposes.
48. Joseph Corbett, Brierly-hill—Improved method of preserving the tuyeres of blast furnaces.
50. Conrad Abben Hanson and John Wormald, Belmont, Vauxhall—Improvements in signal and other lamps.

Dated 7*th January*, 1856.

52. Charles Jarvis and Thomas Deykin Clare, Birmingham—Improved oven or kiln to be used in the manufacture of coke and pottery, and for heating and drying generally.
54. Thomas Barter, Hart-street—Improved apparatus for administering vapour and douche baths.

Dated 8*th January*, 1856.

60. George Baring Locke, Notting-hill, Kensington—Improvements in signalling from trains whilst in motion.
62. Henry Stuart, Liverpool, and Thomas Pritchard, Runcorn—Improvements in watches and chronometers, which improvements are also applicable to clocks and other time-pieces.
64. Samuel Middleton, St. George's-row, Southwark—Improvement in the leather-covered rollers used in spinning machinery.

Dated 9*th January*, 1856.

66. George John Christian Erhard Hald, Manchester—Improvements in the construction of stoves. (A communication.)
68. Victor Jeanne, Adolphe Martin, and Michel Edmond Martin, Paris—Improved grease box for axles, journals, and other rotary parts of machinery.
70. Edward Hallen, Cornwall-road, Lambeth, and William Holland Kingston, Bandon, Cork—Improvements in communicating between the guards and engine drivers, and between the passengers, guards, and engine drivers of railway trains.
72. Anker Heegaard, Copenhagen—Improvements in making channels or flues.
74. Charles Mathew Barker, 25, Kennington-lane—Improvement in the pistons of steam engines.
76. Henry Adcock, City-road—Improvement in casting iron and other metal.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 18*th*, 1856.

1051. Edwin A. Forbush.
1610. Felix Hoyos.
1657. John Walter Cawley Wren.
1659. George Hepplewhite.
1668. Auguste Achard.
1698. Thérése Alexandrine Poncelin.
1702. Thomas Dawson.
1730. William Truran.
1794. Nathaniel Smith.
1843. Mark Mellor.
2164. Thomas Clegg.
2259. Narcisse Leroy.
2267. John Thornton, Albert Thornton, William Thornton, and Henry Thornton.
2295. Thomas and William Hemsley.
2297. Manuel Perez Lozano.
2299. John Stenhouse.
2305. James Miller Brown and Thomas Brown.
2371. Thomas Richardson.
2391. John Andrew Richards.

Sealed January 22*nd*, 1856.

1669. George Handson Rollet.
1674. Henry Stent.
1676. Benjamin Wood.
1677. John Henry Johnson.
1678. John Henry Johnson.
1690. Vincent Scully and Bennett Johns Heywood.
1693. Christian Schiele.
1706. Capt. William Allen, R.N.
1708. John Aaron Benfield.
1712. John Whitehead, jun., and Robert Kay Whitehead.
1747. Alexander Allan.
1767. Robert Richardson and Walter Greenshields.
1821. Edwin Ullmer and William Ullmer.
1837. Thomas Butler.
1972. Robert Walter Winfield and John Jackson.
2032. Robert Barnard Feather.
2147. Felix Bouchet.
2236. James Washington.
2439. William Taylor.
2459. James Pattison.
2465. Thomas Ridgway Bridson.
2470. George Collier.
2485. Alfred Vincent Newton.
2486. Alexander Charles Louis Devaux.
2910. Thomas Godding.
2513. George Tomlinson Bousfield.
2529. William Henry Bentley.
2623. Alexandre Tolhausen.
2654. Hiram Hyde.
2668. Hiram Hyde.
2676. John Henry Johnson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 15*th*.

110. Thomas Potts and James Septimus Cockings.

January 16*th*.

121. Henry Browning.
128. Robert Neale.
131. Joseph Rock Cooper.

January 17*th*.

123. Orlando Reeves.
145. Georges Edouard Gazagnaire.
464. William Spence.

January 18*th*.

138. Peter Rothwell Jackson.
181. Andrew Edmund Brae.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3804	January 21.	Composing Stick..............................	R. Besley and Co.	Fann-street, Aldersgate-street.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 1, 1856.

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EIGHTH ORDINARY MEETING.

Wednesday, January 30, 1856.

The Eighth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 30th instant, J. Allen Ransome, Esq., in the chair.

The following Candidates were balloted for and duly elected:—

Acland, Henry Wentworth, M.D.
Dent, Stanley
Dunn, Joseph Arnold
Girdwood, John
Green, James Allen
Hall, Walter
Hawksworth, William
Hicks, John
Kennard, Robert William
Lawrence, Charles
Levick, Frederick
Maris, Andrew
Orr, Capt. Andrew S., R.A.
Rusby, William John
Sturge, Edmund
Tolhausen, Alexander
Wilson, John

As a Corresponding Member.
Hulot, Anatole.

The paper read was

ON CULTIVATION BY STEAM; ITS PAST HISTORY AND PROBABLE PROSPECTS.

By John Fowler, Jun. (of Bristol).

The importance of the subject we have met this evening to consider, is now almost universally acknowledged; it is a question affecting an expenditure of at least fifty millions sterling annually—the cost of horse labour in agriculture; and its progress is anxiously watched by men who, even three years ago, would have been sceptical of its ever attaining any practical value. Not long since it was the common remark, among both engineers and agriculturists, that, though steam cultivation was probably practicable, yet the cost of ploughing by horse-power was not sufficient to render it remunerative or likely to be generally adopted. But the experience of the last few years, and the advantages that have accrued from the more rapid and perfect execution of barn work by steam-power, have tended to lead the agriculturists to set a different value upon it; and I believe that that body are now quite prepared to give a warm welcome to any means that will give them greater power over the material with which they have to deal, and that will enable them to cultivate the soil more expeditiously and thoroughly, even should there be but little economy over the present plans. In an uncertain climate like our own, time is more essentially money in dealing with the soils than in almost any other operation we can name; and, if that axiom is found universally to hold good in its application to every other sphere of human industry, it must be doubly applicable to the cultivation of the soil, where the loss of a week is often a serious injury to a crop. Of course, economy would be a great desideratum, and I hope to be able to show that cultivation by steam-power may be performed at a little over half the cost of horse labour; but I do not think that this is absolutely essential to its extended adoption.

The change in public opinion to which I have alluded, and which I think I may safely reckon upon, will render it unnecessary for me to endeavour to show its importance, or to do more than allude to one or two matters that may give a more pointed direction to our inquiries.

The work of a farm may be divided into two classes—Field operations, and the cartage of corn, manure, &c., &c. Steam, in its present state, may be easily applied to the former of these, but its application to the latter is still surrounded more, I believe, with the mist of inexperience than with mechanical difficulty. The horses required upon a farm may be materially reduced by the assistance of steam in field operations, and those operations may be, as before stated, more rapidly and thoroughly performed; yet, until steam is also available for carting, it can only be regarded as an important auxiliary; and, though the half loaf may be better than no bread, yet the possession of the first half only renders the other half still more valuable and necessary.

Thus we have to seek the solution of two mechanical problems—first, the application of steam to field operations; second, to the carting and harvest operations of a *farm*. The harvest operations may, possibly, be brought under the head of field operations, and executed by the same machinery; if so, we shall, unquestionably, have gained the largest half of our loaf.

Having thus referred to the points that seem most to require our present attention, I will now ask you to follow me through the past history of our subject, a history that bears an exact resemblance to that of all the great mechanical realities of our age,—the steam-boat, the railway, and even the steam-engine itself; except in the fact that the greater talents, means, and energies that have been devoted to those subjects, have succeeded in more rapidly developing them into great facts. Time will not allow me to trace the resemblance as accurately as I should like. I think it would encourage us to look forward with perfect confidence to a similar reward to our labours in this direction, and one not less important than the best of them, but I must content myself with remarking that its birth was coeval with theirs; like them, 200 years ago, it commenced in the minds of those who are more poets than mechanics, who overleap all practical difficulties, and to whom thoughts are realities.

Every new mind gave greater tangibility to the crudeness of the first conception, until, in our own time, every possible idea seems again and again to have been remodelled and served up with some new lights, but, unlike them, no master spirit has as yet taken this undigested mass and given tangible shape and practical value to their *ideas*. Accompanying this is an abstract of all the patents that have yet been taken out bearing on the question of steam cultivation, with a short notice of their peculiarities, for which I am indebted to Mr. Burness, of the *Mark Lane Express*, and to this I must refer you for detailed information.

There are fifty-five here enumerated, which may be all classed under the following heads:—

1st. Locomotive engines used for drawing agricultural implements. Motion given by driving the wheels, by winding along a chain or rope, by rack railway, and by thrusting on crutches.

2nd. Locomotive engines working rotatory cultivators.

3rd. Rotatory cultivators to be driven by steam, mode of working not specified.

4th. Portable engines, used to wind up ropes.

5th. Portable engines, driving endless ropes, working windlasses.

6th. Portable engines, driving endless ropes, working rotatory cultivators.

As early as 1630, David Ramsey took out a patent for making the earth more fertile, &c. Mr. Ramsey seems to have had an idea that the fire-engine then known could be employed for cultivating the earth; there is no specification of this patent, and he, in common with many of his successors, imagined that any new power must be equally applicable to agriculture as to other purposes.

The next patent was by Mr. F. Moore, in 1767, nearly 140 years later. This patentee's idea assumed a more definite shape on the subject, and, as far as can be judged from his specification, he imagined that steam-power could be applied to agriculture by a carriage travelling over the land, driven by steam, and used for traction. So confident were the patentee and his friends of his success, that they sold all their horses to avoid loss by their reduction in value.

Then follow Edgworth, 1770; James Watt, 1784, who appears only to have specified to prevent piracy, as he considered the boilers were unfit to bear the requisite pressure of steam; Pratt, 1810; Blenkinsop, 1811; Chapman, 1812; Reynolds, 1816; Barry, 1821; Cayley, 1825; Easton, 1825; Clive, 1830. Up to this date the only ideas of applying steam to agriculture that I can find any record of, with the exception of Major Pratt's. were to travel the locomotives over the land, and draw any given implement in their wake. This was proposed to be accomplished in a variety of ways. But in 1832 two patents were taken out by Heathcote and Saxton, the former for traction by a direct pull on a rope from a stationary engine, and the latter by driving an endless rope, and with this rope giving motion to a windlass, to which the implements were to be attached. Heathcote's patent was, I believe, carried out by Mr. Parkes. After this date, various schemes follow similar to those before mentioned, interspersed with schemes for giving motion to agricultural implements by hydrogen gas, by compressed air, by electricity, and even by a portable windmill. In 1836, Vaux, (followed by Hall in 1842, and Bonser in 1846) took out patents for revolving cultivators or harrows, though not specifying the way in which they were to be driven by steam-power, and this is the first record in the Patent Office of any such implement, though I believe the Norwegian harrow must have been known before that date.

Following these, we have an endless variety of modifications of the previous plans, presenting no marked novelty, but interspersed with some improvements in details, which rendered them more practical—as Claussen's, in 1846, for an arrangement of pulleys for conveying power to a long distance by an endless rope, for agricultural and other purposes (though agricultural purposes seem to have been second in importance to the propulsion of boats). Osborne, also, for two engines travelling along each headland winding-up-chain or rope, as carried out by Lord Willoughby D'Eresby. In 1847, appears the first plan for a locomotive engine-working rotatory cultivator, which Usher and "Talpa" have since rendered so familiar to us, and for which an endless variety of patents have since been taken out, interspersed with engines working hoes, spades, &c., but which, I fear, will exhaust strength and ingenuity that might be more profitably applied in a more practical direction.

The six classes previously named include all the schemes of which we find any record in the Patent Office, and I have been unable to obtain any other information, though I have no doubt many plans and schemes may be found scattered through the periodicals of the last fifty years, but as far as any practical purpose is concerned, this is, I think, all that we can require to elucidate the subject.

The present position of steam cultivation may be considered as having been fully represented at the Carlisle meeting of the Royal Agricultural Society in July last, by the machines exhibited there in competition for the Society's prize, and by the plans so spiritedly carried out by Lord Willoughby D'Eresby and Mr. Mechi. Four out of the six classes were represented at Carlisle:—No. 1. By Mr. Boydell's steam horse, that attracted so much attention from its elephantine movements, and which, though, I believe, useless as a mere means of traction for agricultural implements, yet may in time help us materially to a solution of the difficulty involved in performing the cartage of a farm; No. 2. By Usher's, for though many of the schemes for locomotive engine-working rotatory cultivators vary considerably in detail, yet they all agree in the main principle of a rotatory barrel, driven by the engine, to which, of course, different kinds of forks, spades, &c., varying with the nature and condition of the soil, may be attached. I do not think attaching ploughs to the barrel, as in Usher's, is likely to be the best mode of using the power.

No. 4 may be considered to have been represented by the Draining Plough, for though draining is a much heavier and more difficult operation than ploughing, and more power being required in one spot, may be thought better adapted to steam power than the ordinary field operations, yet a trial that has taken place during the last two months has proved its much more easy adaptability to the lighter work.

Class No. 5 was well represented by the Messrs. Fiskens' plan, which for light field operations was the only machine that approached a practical result.

Class No. 4 can hardly be said to belong to steam cultivation, as the mode of applying steam to them was yet to be devised.

Class No. 6 was not represented at Carlisle at all, and is only an idea (I believe a very valuable one) thrown out by Mr. Atkins, of Oxford; and, though provisionally protected, was not specified, but allowed to drop, and is, therefore, now open to the public.

I shall now beg to call your attention to that branch of our subject relating to field operations; and, as the locomotive solely used for traction belongs more properly to the carting of a farm, shall dismiss that for the present.

There are various schemes patented in the last few years for rotatory cultivators, worked by locomotive engines, all varying only in detail; and it has been the favourite subject of many of our agricultural writers; but I believe a little consideration would have spared them all much pains and expense, as, if there is one point more difficult than another from which to approach our subject, it is in this direction. The enormous weight of engines required in which an ordinary farm pressure of steam is used, and the weight necessary to give sufficient strength to the drums and frames; the difficulty of steering such a great load to the nicety required for field operations; the yet unknown difficulties that may meet the rotatory cultivator, though, at first sight, I confess it appears well adapted to the work, to say nothing of the power wasted in moving such a weight over arable land, and up ever so slight an incline, might well deter the most sanguine from any attempt of this kind; but it seems, from the Records of the Patent Office, such a monomania at the present moment, that I do not think it will be waste of time to endeavour to direct the energies of my brother inventors to a different channel. Were I to undertake to make one of these engines, I should first endeavour to make a simple engine, to be used for the cartage of a farm, making it as light as possible, by the use of high-pressure steam, and rendering it perfectly manageable for carting manure, corn, harvesting, &c.; overcoming all the practical difficulties resulting from vibration, &c.; and, at the same time, I should test the value of the rotatory tillage, by driving a rotatory cultivator from a stationary engine, by the use of endless ropes, as proposed by Mr. Atkins, and exemplified by Messrs. Fisken, at Carlisle. Then, should the combination of the two appear desirable, which is very doubtful, it might be accomplished with some chance of success. At present it will only bring with it bitter disappointment and wasted energies.

Of course, with these views, I consider the drawing an agricultural implement by employing a locomotive for direct traction, a still more roundabout and ridiculous plan.

For field operations we have, then, but two plans that can be considered as coming into competition, both of which have, in common, the important consideration of proposing to use any ordinary portable farm engine; both propose to drag any given field implement that may be attached to them, such as a combination of ploughs, harrows, drills, &c., but they differ in the means by which they accomplish the end in this respect. The one draws the implement by the direct traction of a wire rope, and the other by conveying the power from the engine to a windlass by an endless rope, the windlass winding itself up and down the field by winding up and paying off from two drums a wire rope, anchored at each end, or winding along a wire rope, as may be found best. I must premise my remarks on the merits of these plans by saying that I am myself a patentee of one of them, and had I not thought mine the best, I should not have entered on the competition, and I must leave you to judge of their respective merits, after giving you the reasons that led me to that preference. We will first consider the plan of travelling the windlass up and down the field. A small hemp rope is passed round the fly-wheel of a portable engine, placed in one corner of the field, one end being carried round a pulley at the opposite end of the same headland, and again round a pulley at the top of the furrow to be ploughed. It is then taken to the bottom of the field round another pulley at the bottom end of the same furrow, and again brought up the field to the top of the furrow, where passing round another pulley, it is attached to the other end of the rope, passing round the fly-wheel. In its passage up or down the field, it conveys power to a windlass by its friction on a pulley or series of pulleys mounted upon it, and, being set in motion, turns one or two drums mounted on the windlass, and either winds up or pays off two wire ropes, or winds up and pays off a single rope, winding along that rope by friction. The rope that conveys the power is supported at intervals by carriages, and, in order to convey the necessary power, must be made of hemp, and from its great length and the difficulty of supporting it, requires to be very small. As lightness is necessary, speed is also a requisite. It will have to travel at least one-third of a mile per minute to convey seven horse-power to the windlass, but, circumstances being favourable, almost the whole of the power is conveyed to the windlass, the loss by friction being very slight indeed. Any derangement of the pulleys, however, would, of course, at that high speed, consume any amount of power. The windlass, if made strong enough to wear well, with the drums and gear necessary to reduce the speed, cannot weigh less than 30 cwt., and the power required to draw that weight over the land cannot be less than one horse draft; assuming the friction of engine, pulleys, and windlass, at half horse-power, we have one-and-a-half horse-power consumed in keeping the machine in motion. Some experiments I have lately made on the friction of wire rope on the land, show that rather less than two horse-power is required to drive engine, windlass, and wire rope enough to work 20 acres of land (nearly a mile in length), the rope travelling at 2½ miles per hour, and being strong enough to pull up a ten horse engine at that speed. Thus we see that the advantage as respects friction is not greatly in favour of the former *plan*. The disadvantage of the windlass travelling up and down the field is very great, though the plough may be attached to either end of it, and ploughing may be thus easily performed, yet, if you wish to pull any other farm machine when you get to the headland, you have no means of getting the implement to the opposite side of the windlass and going back except by the assistance of horse-power, and this, as will be seen, does not apply to the simple rope, by which the implement can be easily turned. I think, with these disadvantages, the plan of traction by winding up a wire-rope is greatly preferable, as it is much simpler, having fewer wearing parts, is less liable to derangement, and more easily managed. The wear and tear on a hemp rope, at such a speed, and exposed to all sorts of weather, is a point on which I am not competent to form an opinion, but former experience would lead to considerable doubt on this point. Before proceeding to describe the two plans for traction, to which I shall call your attention, it will be well to consider what have been the causes of failure in the previous attempts of Heathcote, in 1837, followed by Osborne and Lord Willoughby D'Eresby. In the experiments that Mr. Parkes, the well-known draining engineer, tried for Mr. Heathcote, the difficulty experienced was, to procure any material that would convey the requisite power without entailing too much weight and consequent friction on the land, and I understand that the material he found best adapted to the purpose, were steel-bands rivetted together at the ends. Lord Willoughby D'Eresby, in the use of chain for that purpose, effectually prevented the possibility of success in his efforts, as the friction of chain on the ground is so great that it would consume almost more power than it is capable of bearing, when of any great length. The present perfection to which the manufacture of wire-rope has attained, has, however, entirely overcome the difficulties that beset *them*; and in Mr. Williams's and my own plan, wire-rope is the only material with which we propose working. Mr. Williams proposes to mount an ordinary portable engine on a frame, on one end of which two barrels are fixed, turned by the engine, by one of which a wire rope is wound up, and passed off by the other; one end of this wire rope passes straight down the field, and the other passing along the frame at right angles to the drum for some distance, and then down the field again, running along the frame anchored at the bottom, and meeting the other rope. The implement to be drawn is fixed between the ropes, and alternately pulled backwards and forwards by these ropes, the two frames being moved along the headlands as the work progresses. My own plan is to mount two drums on a frame, fixing them in one corner of the field, the portable engine being set so as to drive them with a short rope or chain working in pulleys. The ropes are led off the drums to opposite corners of the field, and there passed round pulleys, anchored on a chain stretched between two posts or anchors, and the drums, being alternately set in motion, wind the wire rope backwards and forwards between the two pulleys, which are moved up the field by being allowed to slip along a chain stretched between two posts or anchors as the work progresses, the engine and windlass remaining stationary until the whole field is completed.

My reason for preferring this plan is that I consider the number of pulleys in Mr. Williams's unnecessary, and injurious to the rope, as well as consuming power, and the fixing the windlass and engine on one frame, and moving them along the headland is unnecessary, expensive for first cost, and extremely cumbrous. To these remarks I may be allowed to add that one of my windlasses has been at work for the last six weeks at Mr. Smith's, of Woolston, near Fenny Stratford, who will be able to give you the results of his experience. I believe either of the above three plans is capable of solving the problem of the application of steam to field operations, and Mr. Smith's experience would fully justify me in saying that it may be done at a saving of 40 per cent. over horse labour. Mr. Smith's calculations are as follows:—4 men and boy will plough an acre in 2½ hours, or 4 acres a day. Thus only the same number of men are required as for horse labour, consequently, we have all the horse labour saved, which, deducting the cost of 7cwt. of coal, gives a saving of nearly half, as the wear and tear will hardly exceed the wear and tear of eight horses. Another advantage he considers must not be lost sight of, is that the land is not injured by the treading of the horses in wet weather, and, consequently, he can work it when he otherwise should be at a stand-still.

Having thus, I think, arrived at the conclusion that any given implement may be drawn over the land by an ordinary portable engine, it will be necessary to consider what implements are likely to be best adapted to be used with this tackle, so as practically to make it most serviceable. Ploughing, of course, is the ordinary operation of a farm, and a series of four or five ploughs, fixed in a frame, will at any rate best meet the present wants and prejudices of the farmer. Mr. Williams has invented a series of ploughs that have very considerable merit, and I have no doubt that but little difficulty will be found in adapting ploughs to meet the requirements of the farmer. I think there is every probability that some other implement will, to a great extent, supersede the plough, and to this attention ought now to be turned. Mr. Smith is now, and has been for some years, moving with horse-power, a sort of grubber, instead of the plough, and with, I hear, the best results. But I must confess I see no way of effectually and thoroughly turning over the soil, which is often necessary, both to expose it to the air and bury the stubble and weeds, but by the use of the plough. Still this operation can hardly be necessary very often in a year, and I believe a machine may be made which will take the soil up on a platform to a certain height, then, passing it through revolving harrows, leave it at once in a perfect tilth, and which may be worked by traction. This would offer great advantages, as the soil is often, when broken up, in a fit state to pulverise, but, after the sun's rays have heated it for a few days, it is quite impossible to break it. The sets of implements that may be found best for different soils and circumstances to be worked by steam-power, will be numbered by hundreds; and it is impossible for me to estimate the changes to which the application of steam may give rise, nor will my limits permit me to dwell longer upon it. It is worthy of serious and careful attention, and, I think, deserves at once to be the subject of extended experiments.

I have now to notice the working of a revolving cultivator by an endless rope, and, should experience prove that a rope used in this way is sufficiently durable for the purpose, I should think most highly of this plan. If ever rotatory cultivation is to be brought to bear, I feel sure it will be in this way, and, with the former proviso, I have no doubt experiments in this direction may lead to practical results of great value. It is simple in working, the experiments need not be expensive, and they have a fair prospect of success.

Having thus drawn your attention to what appear to me to be all the most practicable schemes and experiments for performing field operations by steam, I now have to refer to the other branch of our subject, the cartage of material to and fro on a farm. A large team of horses will still be required on a farm to do the necessary carting, going to market, &c., but during harvest every available horse is often required, especially on large light land farms. Can our windlasses be made available for harvest work; if so, the number of horses might safely be reduced two-thirds. The practice of ricking in the field is now common, and where this is the case, there can be no difficulty in using the windlass to bring the corn to one spot. You might fix the windlass in the morning and clear a 20 acre field with it in a short time. It can be removed and fixed again with ease in two hours. The windlass could be also used for carting turnips, but if a traction locomotive could be made available, it would be far better suited to the work. A tramway down the centre of the farm, using the windlasses to the right and left to bring material to the tram, would reduce the horse work to a minimum, but whether the locomotive could not be made to do the carting work of a farm is well worthy of attention. I am assured by Mr. Worby, who made experiments some thirty years back on the subject, that it is perfectly practicable. He has had forty years' experience in the various farm implements with which we are acquainted, as manager for Messrs. Ransome, and may be assumed to know what practical difficulties are likely to lie in the way. The great difficulty met with by Hancock, and others, on common roads, was the speed at which they travelled, but for this purpose three miles an hour will be a sufficient speed. I believe that a few experiments would lead to a successful solution of this problem. One essential to its success is, however, the use of very high pressure steam, so as greatly to reduce the weight of the engine, and consume as little water as possible. This has been pretty much reduced to practice lately at a mill at Navestock, belonging to Mr. Hall, and in a portable engine which he is using, in both which engines steam of nearly 300 lbs. pressure is used. These machines were made by his son-in-law, Mr. Charlton, and have been in work during two years. One difficulty that has beset this subject, the impossibility of driving two wheels, is now overcome by a very simple contrivance, which I am not at liberty to describe to you, and this is a great step in the right direction. Boydell's wheels, also, may form an important auxiliary in certain states of the weather, though I think they would hardly do in constant wear. Were I to attempt the solution of this question, I should use wheels to which Boydell's rail could be attached whenever the state of the weather demanded. Thus there are three directions in which, in my judgment, it would be well to make some experiments; 1st, in implements adapted to be worked with the steam windlasses; 2nd, in a rotatory cultivator, worked by a portable engine, with endless band; 3rd, in a locomotive used for traction to do the cartage of a farm.

I feel confident that a few well-directed experiments, in either or all of these directions, would bring out good practical results in the course of a few years: but I would ask you whether it is right that the carrying out of these experiments should be left to chance, whether, when so important a matter is involved as the rapid development of steam cultivation, it would not be wise to enlist the public in the endeavour to bring them to some practical solution. If left in private hands it may, and probably will, take many years to arrive at any real results, and at the cost of loss and disappointment to many of a deserving but unfortunate class of men, whereas I feel confident that with public assistance, a short time would enable us to solve both the three questions that at present seem most to claim attention, and others that no doubt would arise in the course of prosecuting these inquiries.

APPENDIX.

An Abbreviation of Patents, from the Records of Her Majesty's Patent Office, from 1630 up to the Present Time.

No. 50. Date, 1630.

David Ramsey, Patentee—Short title, "Making the earth more fertile." Object of the patent—to raise water from low pits (as coal-mines) by fire; to make barges go against wind and tide; and to make the earth more fertile. No specification of this patent being enrolled, we are left to guess the mechanism at issue. At this period, steam-engines were termed "fire-engines," and Mr. Ramsey's ideas appear to have been to communicate rotary motion to carriage wheels, and, by such means, propel the carriage and engine forward, dragging after it ploughs and other cultivating implements of the period.

Nos. 921 and 933. Dates, 1767 and 1769.

Francis Moore, Patentee.—"Fire-engine to supplant horses, &c." No specification of either of these patents is enrolled, the only information we can give being the following, abridged from the *Mechanics' Magazine*, vol. 16, page 135. A correspondent writes that Mr. Moore's new invented machine, to go without horses, for which he has obtained a patent, is not only adapted for wheel carriages in general, such as coaches, chaises, waggons, &c., but to ploughing, harrowing, and every other branch of husbandry. Also to all other machines and engines now in use in the kingdom in various branches of manufactures where horses are required. The patentee and his friends were so confident that horses were doomed, and about to be superseded by steam as a motive power, that they sold their teams in order to avoid loss, convinced that they (horses) would soon be reduced to one-fourth their value.

No. 953. Date, 1770.

Richard Lovell Edgeworth, Patentee.—"Endless Railway." No plans were given with the specification of this invention, and the inventor rather leaves us to guess at mechanical details. We are informed, however, that the railway consists of planks of wood on the periphery of cart or waggon wheels. That the wheel, in rolling to the extremity of one plank, lays down another in front, while it lifts a third behind—that the rails or planks on the opposite sides of the wheel would thus balance each other so as to reduce the additional draught on the horses to a minimum; and that the advantages on rough roads and soft ground would be incalculable, not only to the agricultural interest, but all who used carts and horses. The specification is only to be seen in the Roll's Chapel.

No. 1,432. Date, 1784.

James Watt, Patentee.—"Steam Carriage." In his specifications, Mr. Watt states "the propulsion of land carriages"—a specification sufficiently comprehensive to include agricultural implements, as ploughs, sowing-machines, harrows, &c. The patentee, however, never built a steam carriage, for reasons which he himself thus states:—"I soon relinquished the idea of constructing an engine on this principle (high steam), from being sensible it would be liable to some of the objections against Savry's engine, viz., the danger of bursting the boiler (constructed of wooden staves), and also that a great part of the power of the steam would be lost, because no vacuum was formed to assist the descent of the piston."—*Watt's Narrative.* For the purpose of ploughing, the engine would have drawn the ploughs behind it, on the traction principle, as exhibited at Carlisle by Mr. Boydell.

No. 3,309. Date, 1810.

Patentee, Major Pratt.—This is an extensive project, and, from the specification being only to be seen in the Roll's Office, it appears to have escaped general notice. Cultivation of land is performed in several ways. 1. A series of ploughs revolve on a horizontal axis, the ploughs being raised over the ploughed land. 2. Harrows are worked in a similar manner. 3. Land is cultivated by means of chains, having tines or grubbers fixed in them, working longitudinally over two vertical pulleys, one at each end of the machine; and 4, by means of an endless chain passing over horizontal pulleys or carriages placed along the field, one pulley being on each carriage. To one side of the endless chain a plough is attached, and works alternately between two carriages, the carriages being moved forward as the work proceeds. Thus, a carriage on four wheels, one at each end or side of the field, and a locomotive or portable engine in the centre, with endless chain and two ploughs, would form the details of the project for ploughing a field of land.

No. 3,431. Date, 1811.

John Blenkinsop, Patentee.—"Certain mechanical means, by which the conveyance of coals, minerals, and other articles is facilitated, and the expense attending the same rendered less than heretofore." The specification of this patent informs us that it consists of the application of a rack or toothed rail laid down on one side of the roading from end to end. Into this rack a toothed wheel is worked by the steam-engine, the revolution of which wheel produces the necessary motion, without being liable to slip in descending a steep inclined plane." Mr. Blenkinsop, in reply to queries put to him by Sir John Sinclair, stated that his "patent locomotive engine, with two eight-inch cylinders, weighs five tons, consumes two-thirds of a hundred-weight of coals and fifty gallons of water per hour; draws twenty-seven waggons, weighing 94 tons, on a dead level, at three and a-half miles per hour, or 15 tons up an ascent of 2 inches in the yard; when lightly loaded, it travels ten miles per hour, does the work of sixteen horses, and costs £400.—*Engineers' and Mechanics' Encyclopædia.* For field purposes a portable rack railway was proposed.

No. 3,632. Date, 1812.

Patentees.—The Messrs. William Chapman, Durham, and E. W. Chapman, of Wallsend, Northumberland. A "Steam carriage with a rigger working on a stretched chain or rope, secured at both ends by anchors." It was worked for some time on a railway, but was obliged to be given up, it is said, owing to "the waste of power arising from the excessive friction of the chain or rope." Several propositions have been enumerated of rigger traction for actuating ploughs, &c., in the field, on the principle adopted in this patent.

No. 3,973. Date, 1816.

Joseph Rynolds, Patentee.—"Steam carriage for ploughing, carting, rolling, drilling, threshing, &c.," the former being on the traction principle. There are some good points about this machine deserving of notice, such as the reverse action of the wheels—enabling the carriage to turn on an *area of its own length.* The broad roller wheels, again, to prevent them sinking in the soil, have since been adopted by several patentees. It is only to be seen in the Rolls Chapel.

No. 4,575. Date, 1821.

John Richard Barry, Patentee.—"Endless railways." The principle carried out in this project is that of a heavy body moving on rollers. A series of wheels and axles working in plummer blocks fixed in two endless chains, one at each side of the carriage frame, pass over four chain pulleys, two on each side. Each axle has four wheels, two at each side, the one being less than the other. The largest two act as wheels for supporting the carriage on the ground; and the smaller two for rollers under the frame of the carriage. When the ground wheels come to an obstacle, they remain stationary, the carriage rolling over the other two, setting down two wheels in front of the carriage over the front two chain pulleys, and taking up two wheels behind for each of the two purposes involved; the ground wheels, and roller wheels, the axles, wheels, and chains in which they work passing over the chain pulleys.

No. 5,260. Date, 1825.

Sir George Cayley, of Brompton, Yorkshire, Patentee.—"Endless railway." This project is nearly the same in principle as Mr. Barry's above, but differs considerably in mechanical details. It has less merit, indeed is hardly worthy of further notice.

No. 5,267. Date, 1825.

Josiah Easton, Patentee.—"A rack and pinion railway." This is a similar project to that of Mr. Blenkinsop's, already noticed, the difference being, that Mr. Easton places the rail in the centre of the roadway, whereas his predecessor had it at one side. The advantage of this is the obviating the strain experienced in Mr. Blinkensop's case from the rack being at one side only.

No. 5,950. Date, 1830.

John Henry Cline, Chelt-house, Staffordshire, Patentee.—"Certain improvements in the construction of, and machinery for, locomotive ploughs, harrows, and other machines and carriages." The improvements here consist principally (1) in the enlargement of the carriage wheels for supporting the engine, (2) attachment of a crank pin to one of the spokes, with a greater crank radius than ordinary, and (3) in using a broad roller wheel under the centre of the carriage, for driving and steering.

No. 6,172. Date, 1831.

Miles Berry, Patentee.—The improvements contemplated by this invention have principally reference to engines and boilers of stationary or portable engines for agricultural purposes.

No. 6,267. Date, 1832.

John Heathcoat, Tiverton, Devon, Patentee.—"Certain new or improved methods of draining and cultivating land; and new or improved machinery and apparatus applicable thereto; which machinery and apparatus may be applied to divers other useful purposes." This machine is principally for cultivating soft mossy lands. It consists of a broad endless strap or floor, passing over two large pulleys, one at each end of the steam carriage, and four intermediate small pulleys, each pulley consisting of three discs or wheels the endless floor forming a railway, and the pulleys the wheels of the carriage, six on each side. Between the two endless railways, the boiler and engine are placed. For ploughing, one end of a drag rope is fixed on to a long drum, situate longitudinally over the boiler, and in length equal to the length of the field coiled upon it. The rope then passes to the opposite headland round a large pulley there of an auxiliary carriage, which serves for an anchor. The rope then returns, and is fixed to the opposite end of the long drum. To one side of this rope the plough carriage is fixed. The drum is then set in motion, when it coils up the one end of the rope as it gives off the other, the engine-carriage and auxiliary-carriage moving along opposite headlands as the work of ploughing advances.

No. 6,531. Date, 1832.

Joseph Saxton, London, Patentee.—"Differential pulleys." This is a rigger motion and traction machine. The parts claiming notice consist of two riggers or pulleys of different diameters on one axle, situated vertically in the centre of front part of the carriage or locomotive. An endless rope passing over two anchored pulleys takes a turn, the one side round the larger pulley of the carriage, and the other side round the lesser one. To gain a high velocity, motion is communicated to the small rigger, and *vice versa*, to the large; this, however, is only one way out of several proposed of putting the rope or ropes on the riggers,—a second plan was, to have a single rope taking one turn round the rigger of the carriage, the two ends being alternately wound upon two anchored drums at opposite head-lands,—and a third plan was to have a single traction rope, as in the case of Chapman's patent, and an endless or single rope for driving, the traction rope taking a turn round the small rigger of the carriage; for slow motion, the driving rope working on the other, and the reverse for quick motion. Several very ingenious plans were adopted to obviate the cutting action of the ropes where they pass each other on the riggers, as, a slight divergence from a right angle with the axis, pulley guides, &c. The project was reduced to practice, and tried on a piece of railway near Regent's-park, but did not answer. The principle of mechanism involved, as applicable to agricultural purposes, is that of a travelling windlass, and gave rise to numerous suggestions of improvements at the time, as the cart wheel, subsequently noticed.

No. 7,118. Date, 1836.

Thos. Vaux, Land-surveyor, Essex, Patentee.—"A revolving harrow." Strictly speaking, this machine has no connexion with steam, but as it has on several occasions been quoted in opposition to patents for rotary steam cultivators, as Hoskyns's, and may be wrought by that power, we give it. The same patentee holds patents Nos. 7,446, 7,624, and 7,905, all in connexion with the culture and fertilisation of land.

No. 7,458. Date 1837.

John Upton, Engineer, Surrey, Patentee.—"Steam boilers applicable to agricultural purposes," or "an improved method or methods of generating steam-power, and applying the same to ploughing, harrowing, and other agricultural purposes, which method or methods is or are also applicable to other purposes, to which the power of steam is or may be applied." Mr. Upton's engines are on the rotary principle. There are two of them—one on each side—on the shafts of which are two small pinions—one on each. These gear in the top of two spur wheel on the axle of the running wheels of the carriage, similar in principle to what has been adopted by Mr. Boydell. The specification of this patent has been printed, and to it we refer for details.

No. 7,547. Date, 1838.

Ambroise Adoe, of Leicester-square, London, Patentee.—Improvements in obtaining motive power for various purposes, including the propelling of land carriages by means of ignited hydrogen gas in chambers at the extremity of revolving arms, on a common spindle, something on the principle of Barker's mill. If this gas is poured into a chamber by means of a valve in the centre of the arm, this valve closed, another opened at the side, and the gas at this vent ignited, the recoil action will force round the arm of the mill, and thus communicate motion to machinery.

No. 8,207. Date, 1839.

Henry Pinkus, of the Old Slaughter Coffee House, St. Martin's-lane, Patentee.—A stationary engine forces compressed air or gas through main pipes in the ground, supplying the engine of a locomotive ploughing apparatus, &c., by means of vertical pipes at certain distances, and an elastic tube communicating between the two. As the locomotive advances, this elastic tubing is unwound from a drum, and in returning is wound upon the same. The inventor assumes that an estate of 16 miles might be laid down with main pipes, and cultivated with one engine in a central position.

No. 8,329. Date, 1839.

Alexander McRae, of British Guiana, took out a patent for steam culture by means of a portable engine, endless rope, the necessary anchorage, and two series of ploughs in a carriage or frame on wheels, one for ploughing up land and the other down. The invention was principally intended for the low level lands of Guiana, intersected at short distances with a net-work of canals. Accordingly, the steam engine was placed in a punt or barge at one side of the field, and the anchor, so to speak, with its pulley in another at the opposite side, the two sailing up or down as the work of ploughing or harrowing progressed.

No. 8,331. Date, 1840.

John Lee Nicolas, Clifton, Bristol, Patentee.—"Certain improvements in the method of constructing and propelling carriages on common roads and through fields for agricultural purposes." Claims the method of propelling carriages or ploughs by means of crutches or legs, and working them by means of arms mounted on a shaft and actuated by motive-power. Vibrating levers are weighted at one end, the other having a joint with a pending lever or leg with a shoe. As the arms revolve, the shoes or feet of the legs press against the soil, forcing the carriage forward.

No. 8,644. Date, 1840.

Henry Pinkus, St. Martin's-lane, Patentee.—"Improvements in the methods of applying motive-power to railway carriages, canal boats, and agricultural machines." As to the latter, in a given area of land a central station is erected, in which is here placed an electric battery or batteries, having wells and tanks placed in the same. From the station main pipes are laid down, having at intervals of 200 yards or so, short, vertical, supply branches, terminating in a box with a moveable lid. In the main pipes wires are laid connected with the positive and negative poles of the battery, thus constituting electric circuits. In the locomotive engine an electric magnetic engine is applied, and in order to set the former in motion, chemical action is induced in the batteries at the station tanks, and electrical influence being thus generated, the force of which acting through the metallic circuit, the wires passing round a small drum will put the impelling engine in motion.

No. 9,402. Date, 1842.

Joseph Hall, Cambridge.—"Certain improvements in machinery for tilling land." This is a rotary cultivator, and, like Mr. Vaux's, is not a steam one. It involves principles, however, to which reference has also been made in taking out patents for rotary steam cultivators, and therefore we quote it. In it the rotary "delving machine" moves at right angles, or an angle from the line of progression of the carriage, so that the velocity of the latter does not interfere with that of the former, beyond giving it a diagonal direction, *i.e.*, if the diggers rotate at right angles from the line of progression, the spit or furrow which they cut will be in a diagonal direction from it.

No. 10,185. Date, 1844.

Wm. Stace, of Berwick, Farmer, and Philip Vallance.—"Improvements in applying power for draining or working ploughs, and other instruments used for agricultural purposes." This is no less than a locomotive windmill for ploughing land, &c. Two long poles are anchored, one at each end of the field; to each of these two pulleys are fixed. At the opposite ends of the two poles a frame is anchored, containing three more pulleys. An endless rope passes over the whole of these, a double rope stretching along the field. On each rope a plough is fixed, the ploughs being at opposite ends, worked by two ploughmen. A portable windmill sets the whole in motion, and the ploughmen can stop their ploughs at pleasure without stopping the windmill.

No. 10,578. Date, 1845.

John Baptiste Simson Teissier, Engineer, and Antoine Hippolyte Triat, Professor of Gymnastics, Paris, Patentees.—"Propelling vessels, carriages, and agricultural machines." The specification of this patent is printed, and to it we refer for details. The method of propulsion is by crutches (or propellers, as the patentees term them). A series of these operating by a crank shaft below the engine, forces the carriage forward as the cranks revolve by catching hold of the ground. The drawing represents a series of spade-shaped cultivators, following in a second tire across the path of the carriage, forcing themselves into the ground by their own weight, and tearing up the soil on the principle of action exemplified by the old Roman plough.

No. 11,297. Date, 1846.

Thomas Bonser, of Merton, Surrey; and Wm. Pettitt, Lambeth, Patentees.—"Certain improvements in machinery for tilling land." This has been termed a "screw plough. "It consists of a shaft or drum with radial cutters, or prongs, or tines, either straight or curved, attached thereto and arranged around it spiralwise, and is proposed to be actuated either by horse or steam-power.

No. 11,303. Date, 1846.

Peter Claussen, of Leicester-square, London, Patentee. —This is a large project, under the title of "Improvements in methods of—and apparatus for—propelling, and exhausting, and compressing air and aeriform bodies." The specification is printed, and comprises nine pages of letter-press and six large drawings, and to these we must refer for details. The method of working ploughs is by rigger traction, but the plan of tackling the riggers adopted by Mr. Claussen is different from that of his predecessors, Chapman and Saxton.

No. 11,304. Date, 1846.

John Tulloch Osborne, Esq., of Demerara, Patentee.—"System of steam ploughing." According to this plan, two portable engines are used, one for pulling the one way, and the other the opposite. Each engine has two drums, the one giving off rope to the opposite engine, and the other taking in rope. Portable railways, or tramways, are placed about 100 to 200 yards asunder, and on these the engines travel across the field, ploughing the land between them into ridges. Two plough-carriages, on wheels, are used, having one-way ploughs, one being drawn the one way, ploughing the one side of the ridge, while the other is being drawn the opposite way, ploughing the other side of the ridge, or the corresponding side of a second ridge, according as the ploughs are made, so that both engines are always kept in use. At the headlands, the ploughs are shifted from the one side to the other, as in ploughing with horses. Each plough-carriage, as it advances, lays down the return rope. In level land, intersected by rivers, canals, or ditches, provision is made for placing the locomotives one at each side of the field—so as to permit of the lands between them being ploughed.

No. 11,907. Date, 1847.

Sir John Scott Lillie, of Fulham, Patentee.—"Improvements in machinery for tillage, &c." The specification of this patent is printed, and we shall again refer to it for details. It is hardly possible to give in a few words an intelligible description of Sir John's project. The carriage has two set of wheels, one for running from headland to headland, and the other transverse ways across the field. The former have endless railways, consisting of jointed rails passing over skeleton rails, one at each end of the carriage for each endless chain of rails, passing under and over these wheels on each side. Either ploughs or rotary tillers are used, or both. A rope is stretched along the field, and anchored at each end by "grapnels" in the ditch. This rope takes a turn round a rigger, or "whelp wheel," on the locomotive; motion is given to this wheel by the engine, with the necessary intermediate gearing, when the whelp wheel winds its way along the rope, ploughing or digging, as the case may be, or both, at one operation. In cutting corn the machine moves sideways on the transverse wheels, cutting its own length as it proceeds. To effect this, two drums are placed, one at each end of the long carriage. Over these, endless straps or chains work, having scythes fixed at short intervals in them, and set at an angle for cutting. On motion being given to the drums, the chains and scythes revolve at a rapid pace, cutting the corn as they proceed. We cannot conclude by saying there is much appearance of successful practice in this project.

No. 11,977. Date 1847.

Pierre Philippe Celestin Barrat, of Paris, Patentee. —"Improvements in machinery for tilling and working land." This machine cultivates the ground with mattocks; the object of the invention, as he tells us, being to imitate the action of such a tool when worked by man. For this purpose, or to accomplish this, a frame is placed behind the engine, about three-feet from the ground. In this frame is a transverse shaft, in which are sockets for receiving the handles of the mattocks. This frame and shaft have a longitudinal reciprocating motion. The handles are raised by stud pins in rollers, and when up to their proper height, are relieved by means of springs, when they fall to the ground, and thus, by the three movements, progressive, transverse, and vertical, penetrate the soil and turn it over. The patentee claims, 1st. The arrangement of two rows of mattocks, to which, on the one hand, an alternate rotary movement is given; and on the other hand, a "to-and-fro movement," in such a manner as to imitate as much as possible the working of a mattock by the hand; 2nd. The mode of giving increased power to the instruments as they fall into or enter the ground; 3rd. The means for regulating the height of the frame and mattocks from the ground; 4th. The means of regulating the speed of the carriage when at work; 5th. The means of regulating the speed of the carriage when travelling from field to field; 6th. "Combining wheel," for changing the speed of working, and for stopping, &c.; and 7th, arrangement of machinery to securing an equilibrium, notwithstanding inequalities of soil.

No. 12,710. Date, 1849.

James Usher, Edinburgh, Patentee.—"Improvements in machinery for tilling land." This rotary steam-plough is too well-known to require description.

No. 12,860. Date, 1849.

George Galloway and Robert Allen Purkis, Patentees.—"Apparatus for ploughing land." This machine consists of a triangular frame, connected with a locomotive engine. At each angle of this frame are three chain pulleys on one shaft. Over these, three endless chains, carrying coulters or other tilling apparatus, work, so that with the progressive motion of the frame and transverse motion of the chains and tilling apparatus, a furrow is made diagonally, the one tiller following the other, so as to cultivate the whole of the land regularly.

No. 12,930. Date, 1850.

Henry Cowing, Blackfriars, London.—"Improvements in obtaining motive power, and in steam and other ploughs, in land carriages, in fire-engines, in raising water for draining and other agricultural purposes." No specification enrolled.

No. 13,159. Date, 1850.

Paul Rapsey Hodge, Adam-street, Adelphi, London, Patentee.—"Improvements in certain descriptions of steam engines, and in their apparatus and management for cultivating and manuring the soil, and treating the produce thereof. This is an improved steam digging machine for cultivating the land, and mixing the manure spread upon it. It consists of two series of spades, on two crankshafts, at the back part of the machine. The handles of the spades work in slide sockets, from which they are expelled by a spring for the purpose of throwing off the spit.

No. 13,168. Date 1850.

Weston Tuxford, Boston, Patentee.—"Improvements in machinery for crushing and pressing land, to be wrought either by horse or steam power."

No. 13,222. Date 1850.

George Thomson, Regent's-park, Patentee.—"Certain improvements in machinery and apparatus for cutting, digging, or turning up earth, applicable to agricultural purposes." A crank shaft digging machine, with apparatus for turning off the spadefulls of earth when lifted by the diggers. The machine may be actuated either by a stationary engine in any part of the field, or by one attached to it.

No. 13,564. Date 1851.

George Guthrie, Chamberlain to the Right Honourable the Earl of Stair, Wigton, Patentee.—"Improvements in machinery for digging, tilling, and working land." A forking machine. Claims—1, General arrangement of forks; 2, Mode of turning them by a screw travelling slide; 3, Use of guides for directing the forks; and 4, System of digging and turning the forks.

No. 13,757. Date, 1851.

David Stephen Brown, Old Kent-road, Surrey, Patentee.—"An improved agricultural implement." This machine is on the rotary principle, and consists of blades or cutters fixed on spindles, of which two are used, one in advance of the other—the front cutters being smaller than those behind. The bearings supporting the spindles have a vertical motion, on a joint, to permit of their being raised so as to take the blades out of the ground. The machine may be either wrought by horse or steam-power.

No. 13,943. Date, 1852.

Martyn John Roberts, Gerard's-cross, Bucks, Patentee.—"Improvements in Agricultural Implements." This is another machine on the rotary principle. A series of discs revolve on a shaft, carrying rocking bars towards their circumference, armed with tines or diggers. These bars, working by means of eccentrics on the axis of the discs and connecting rods, give to the tines a reciprocating motion, independent of the rotary, the object of which is to make them enter the ground in the easiest manner, and loosen the soil so as to make the best work. This mechanism is very complicated.

The following are under the new statute, and hence are printed. We shall merely give the number, date, name of patentee, and title, referring to the printed specifications for the rest.

No. 764. Date 1852.

Thomas Chrippes, Land Agent, Petworth, Sussex, Patentee.—"Tilling land."

No. 949. Date, 1852.

John Bethell, Westminster, Patentee.—"Apparatus for digging and cultivating land."

No. 965. Date, 1852.

Denis John Murphy, Cork.—"Machine for cutting, turning-up, and pulverising land."

No. 1,151. Date, 1853.

John Henry Johnson (pro Romaine, Canada).—"Machinery for effecting agricultural operations."

No. 1,899. Date, 1853.

Chandos Wren Hoskyns, Esq., Wraxhall, Warwick.—"Application of steam-power to cultivation of the soil by means of rotary tilling machines."

No: 2,147. Date, 1853.

Henry Jeanneret, M.D., London.—"Machinery for digging and tilling land."

No. 2,418. Date, 1853.

Alexis Dussuc, Brompton.—"Machine for digging and cultivating land."

No. 2,530. Date, 1853.

Joseph Bauer, Vienna.—"Machine for digging and harrowing by means of steam power."

No. 41. Date, 1854.

John Henry Johnson.—Machinery and rotary engines for effecting agricultural operations.

No. 260. Date, 1854.

Thos. Atkins, Civil Engineer, Oxford.—Apparatus for transmitting power to agricultural machines.

No. 431. Date, 1854.

James Boydell, Camden-town.—Endless railway.

No. 1,293. Date, 1854.

William Southall, London.—Machinery for breaking up or pulverising land.

No. 1,325. Date, 1854.

John Allen Williams, Wilts.—Machinery for ploughing and cultivating land.

No. 1,487. Date, 1854.

John Henry Johnson.—Agricultural machines, &c.

No. 1,626. Date, 1854.

Beaumont Cole, Hertford.—Agricultural machines.

No. 85. Date, 1855.

John Henry Johnson (pro Romaine, Canada).—Digging machines.

No. 288. Date, 1855.

George Tomlinson Bousfield, Brixton.—Steam-ploughs.

No. 1,030. Date, 1855.

John Allen Williams, Wilts.—Apparatus for applying steam power to agricultural machines.

Patents not Specified for 1855.

1,177. May 24.—Baron Von Gelgenhemb.
1,348. June 12.—A. W. Ford.
1,629. July 19.—Messrs. Fisken.
1,642. July 20.—John Henry Johnson, Patent Agent.
1,953. August 29.—J. Hanson.
2,224. October 5.—P. A. Halkett.
2,551. November 13.—F. A. Wilson.
2,766. December 7.—J. A. Williams.
2,848. December 17.—O. C. Evans.

It has been proposed to dig land on the principle of the steam-hammer. Suppose a series of oscillating cylinders constructed on the principle of the steam-hammer; but, instead of the hammer, a large fork, with a swivel action on the piston rod for turning off the spit. You will readily perceive that it would not take a vast amount of engineering to make the steam drive the forks into the ground; lift them out by one crank shaft motion; turn the fork by a second on its swivel; advance another step by intermittent progression, and so on. All this is plain sailing, at least on paper.

DISCUSSION.

The Secretary stated, that he had received several communications in reference to Mr. Fowler's paper, which, with the permission of the meeting, he would now proceed to read, taking them in alphabetical order:—

Mr. W. Bridges Adams says,—"As surely as steam-power has become the substitute for wind, water, and animals, in the processes of grinding, beating, pumping, lifting, and propelling, in mills, on farms, in mines, and on land, river, and sea, so surely will it be the means of performing like operations on farms, in ploughing, harrowing, and transport, and yet other things, till such time as a new motor shall be discovered, combining equal power with diminished weight of machine.

"In the application of steam to its yet desirable purposes, we should first define what those purposes are. The first is, to break up the ground to give access to air, and give, or get rid of, moisture. The second is, to impregnate the ground with the various chemical materials known under the general name of manure. The third is transport, to bring the mechanism and materials of produce on to the ground, and to carry the produce off the ground.

"In breaking up the ground, the mode of working must be determined by the quality of the ground. If homogeneous, as clay, or loam, rapid rotary action will be found the most desirable; if stony, and especially if the stones be of various sizes, the ploughing or grooving action will be the best. Whether the cutting of the ground be produced by a locomotive engine directly, or by a fixed engine through the agency of ropes, it is desirable that the engine should be as light as possible, and to possess lightness, together with great power, steam must be used of the utmost possible pressure. A small boiler is essential for lightness, and with a small boiler, fortunately, the strength of resistance increases. But after a certain point the radiation of heat becomes excessive, though the pressure remains the same, and for the sake of economy in fuel, the means of confining the heat must be very different from what we at present employ.

"If the locomotive engine be used for motive power, we must use rails; and then the question arises whether we are to use the portable rail laid in short lengths round the wheels, or portable rails of another class which we may call moveable, or rails laid down as a fixture. The wheel rail, or, as we may designate it, the ground-shoe, is not all advantage. It is an additional weight constantly moving about, and extra force is required to move that weight, and overcome the adhesion to the ground. Fixed rails would be too costly, and would involve the levelling of the ground in plateaux, and many other arrangements, and we may, therefore, dismiss them, and consider the subject of portable or moveable rails.

"Whether they are to be used for a locomotive engine or merely for wagons, must determine the question of position, strength, and the amount of bearing surface requisite to prevent their sinking into the ground. But in any case, the attachment of the rail bars to each other must be such as to constitute them a continuous bar of sufficient strength for the object, and without any surplus weight, and for this purpose they must be wholly of iron, and not involving the use of timber, increasing the bulk and weight. If the connexion of the bars be perfect, a much lighter rail will suffice, on the well-understood principle that a beam with fixed ends will bear one-half more load than one with the ends loose, the relative strengths being the same. A good form for the rail is a bar of ⊥ section, with the vertical rib above the flat base. A better form would be a cruciform section, giving greater vertical depth. A model is laid on the table, of a ⊥ rail of 28lbs. per yard, connected by a joint rendering it a continuous bar. The wheel to run on this rail should be a double-flanged sheeve, taking a vertical pressure, and not tending to thrust the rails out like an ordinary coned wheel. And the wheels should be arranged to revolve independently on their axle, while the axle also revolves in the ordinary bearings.

"If it be desired to run a locomotive on a light rail, it would be a very practicable thing to use Mr. Boydell's wheel shoes for slow rates of speed. In this mode, the bearing of the wheel being extended, the rail would not be damaged by the increased weight, and the adhesion would be increased so as to prevent slip on inclines. And the disadvantage of lifting masses of mud in wet weather would be avoided.

"With the rail-bars firmly and efficiently connected together, it would be very practicable, by means of Mr. Boydell's engine arrangement, to slew the rails laterally by applying force at the end, and thus changing the course of the line when required. Something similar to this is done in Wales for the purpose of delivering and stacking slate from the quarries.

"The mode of applying the force of the pistons to the peripheries of the wheels in order to make the portable farm engine locomotive is exceedingly useful. It is the converse of the plan of Mr. Whitworth for a street-sweeping machine, where the wheels, moved by the horse, give motion to the machinery instead of the machinery to the wheels, as in Mr. Boydell's engine.

"The shoes, as applied to the engine, appear clumsy, and are rather adapted to make the engine locomotive, with a view to its own transit, than for the purposes of haulage. But this is a most valuable application, and when applied on a light rail to enable it to do the work of a heavy one, the disadvantages are lessened, as compared with the ground surface, and especially if a ploughed field, where the poaching would be very like that of horses feet. Altogether this simple arrangement of Mr. Boydell is a great move in advance towards steam farming.

"Thus far we have a portable engine adapted for all the uses of machinery as a fixed motor, and also as a tool of transit; but this is not all the purposes it may be made to serve. There are purposes other and quite as important to which it has not yet been applied.

"The process of manuring land is tedious and costly. In the ordinary methods a large mass of material has to be carted on to the field, much of which goes into the atmosphere. In improved methods, chemistry reduces the bulk of the manure, and in modern practice dilution with water is superadded. But in all these cases a considerable bulk and weight has to be transported.

"It is mostly considered heretical to bring novel theories before an audience, and the more especially if they be untried. But there are some processes that would not exist at all unless they began as theories, and the only hope of their becoming practice is to promulgate them. It is in the hope that some one may be induced experimentally to solve the question, that the writer puts forth his problem.

"In the production of vegetation three conditions are essential. First, the chemical constituents of the plant. Secondly, moisture, to dissolve those ingredients. Thirdly, warmth, to assimilate them. Some of the constituents are gaseous in form, and are easily evaporated. It would, therefore, be desirable to dispose them as low as convenient under ground, in order that as they ascend they may encounter and be absorbed by the roots.

"We drain our land artificially, and the land thereby becomes warmer, and a more generous kind of vegetation grows on it. Manuring land without draining it would be of little use. But there are times when wetting or moistening the land is also required. The problem then is how to manure, water, and warm at the same time, and apply these three ingredients of gases, warmth, and moisture in contiguity to the roots of the plants in such a position below them that they may ascend.

"This is a practicable matter in several modes. Suppose a series of earthen pipes, analogous to the drain pipes, to be laid at a small distance above them. We may imagine them a continuous pipe in a serpentine form, with a large pipe at the entrance, and a large pipe at the exit. The entrance pipe we may suppose analogous to the fire-box of a locomotive boiler, the exit analogous to the smoke-box. The intermediate serpentine pipe would then represent the tubes. A steam boiler, which may be the boiler of our farm engine, is then connected by a pipe to the entrance of the underground system. In that boiler are placed the materials of carbon, ammonia, and other gases, all at high pressure. The valve being opened, the steam and gases will sink through the underground pipes and saturate the ground, depositing therein heat, moisture, and chemical material. At first the steam will condense near the entrance; as the ground warms it will go further, and so on till it reaches the extremity, and the heat and steam will ascend, carrying with them the gases, and neither heat nor gases can escape, save upwards, if the exit and entrance be stopped, and in their passage upwards the rootlets will absorb them.

"Probably smoke from a close furnace might thus be injected, being connected to the entrance pipe, and a blower for the purpose of exhaust, worked by the engine, being placed at the other end. Whether the dry gaseous heat, or smoke, or the moist gaseous steam would be the best, would be a subject for experiment. But if the process of manuring could be performed by gases, it is obvious that an enormous cost in transit of bulky and heavy manure would be avoided.

"One condition of health in human beings is said to be to keep the head cool and the feet warm. Bottom heat is a favourite heat of the gardeners; and the reduction of heat in the greenhouse and hothouse at times is an absolute condition of the health of plants therein. In truth, plants like to keep their feet warm and heads cool, as well as we do ourselves. If a warm steam pipe or flue pipe be any where underground near a grape vine, the roots will infallibly find their way to it, and cling round it affectionately.

"We want then to prove practically and experimentally what would be the results of the products of combustion, heat inclusive, of a ton of coals deposited underground, and to what extent of area it would be beneficially available in aid of production.

"That it would be of large benefit we have no reason to doubt. In Saxony, and elsewhere, the effects of burning coal-pits under ground are evident enough by the green grassy sward, which contrasts so beautifully with the surrounding country when—

> "'The long dull wolds are ribbed with snow.'

"It would be a very delicious thing to keep our gardens green throughout the winter by this process, and with dry warm walks. But there is yet more than the gratification of the eyesight.

"Vegetables not required to ripen do not need much sun, as celery, which we use in the winter, though sun is most important in the ripening process. It might, therefore, be possible to grow vegetables for green use throughout the whole winter, upon the same principle that Indian corn or maize, which cannot find in England sufficient sun to ripen it, will yet serve as a very delicious green vegetable.

"It would add very materially to London comforts, if the sloping banks of railways looking south could be thus cropped for winter use. There is also another consideration. We break up the surface of the ground to let in air, moisture, and gases from above. It is just possible that the steam process may fissure the ground more advantageously from below, and thus the cost of digging and ploughing be saved in peculiar positions.

"It may be objected that quickening vegetation underground would the more expose it to be nipped by frost. Possibly, but possibly also vegetables could be acclimated to this, just as trees, animals, and human beings change their character. 'There are more things in heaven and earth than are dreamed of in our [existing] philosophy;' and it were well to find them out, or disprove them practically. Gaseous food might prove to be to plants what hot coffee or nourishing soup is to ourselves; and it would be a useful discovery to find that the engine power of Sydenham might be turned to account to keep the gardens green at the season when fountains are too chilly to be pleasant.

"In all processes for farm improvement it will be well to recollect that the essential element, the basis of every thing, is—coal—and for the transit of coal there is no cheap method but railways. Farming improvement, therefore, means the gradual introduction into farms and villages of a cheap class of railways and locomotive engines, worked economically at low speeds. And the same engines will ultimately draw trains, pump water, thrash corn, cut hay, plough the land, and inject it with its vital fluid—steam—as well as perform many more mechanical operations than are as yet marked out for it.

"These suggestions are given in the hope that those who have leisure and opportunity, and appliances, will, after they have done laughing at what doubtless will at first be considered as wild theories, try to prove or disprove them practically. I believe it will turn out they are all of them simply new forms of doing old things, doing by art what has hitherto been done by nature, and all capable of verification analogically. Stirring the earth has hitherto been a process all moulded on the anatomical structure of a horse; the horse being invented first, the plough followed. But in cotton, iron, and wood machinery, are to be found abundant processes applicable to the cutting and carving of earth for agricultural purposes. The imagination of the poet is not needed for this, but only the perception of the analytic discoverer.

"In September, 1845, the writer promulgated these ideas in an article in the *Westminster Review*, entitled 'Railway Improvement.' This is a second attempt to draw public attention to it."

Mr. R. Garrett, of Leiston Works, Saxmundham, says—"I have tried portable engines to draw by wind ropes and drawing endless ropes for ploughing, and, as far as my experience has gone, the result has not been favourable. The friction of the length of rope which is necessary for field cultivation on lands not level, and its coming in contact with the surface, added to that of the loss consequent on the friction rollers, and other guide and winding pullies, absorbed in my experiments so much of the motive power as to leave the power given off by the engine, to be exerted upon the work done, so reduced as to render the advantage of steam over horse power of small moment as compared with the outlay. I also found some considerable difficulty in sufficiently simplifying the arrangement of such ropes, whether made of wire or hemp, for management by farm labourers, or for the ordinary shape of fields as now cultivated. I witnessed some experiments of Lord Willoughby d'Eresby's with much interest, some few years since, and was there equally disappointed, through the same cause, and I think the results of his lordship's valuable experiments would lead him to the same conclusion as myself, with regard to the loss of power by the rope over the surface of the land. If I mistake not, in the experiments I allude to, at Stratford, the power given off a 10-horse engine was barely able to draw two furrow ploughs, thus losing six out of ten horse power in a small field. I have seen some experiments in ploughing with Boydell's tractive engine, and the result was certainly more advantageous, and the machinery less difficult to adjust and manage, than with a rope over a portable engine stationed. On the occasion to which I allude there was no steam indicator on the boiler, but we were informed that the engine was only working up to 12-horse power, and it drew ploughs turning four good furrows, on land which, I was informed by disinterested farmers on the spot, would have required three good horses to turn each furrow as well as this engine performed the four at one time. As all new inventions require perseverance to perfect, I am of opinion that a great deal of good is to be got out of Boydell's engine for field cultivation, as well as for other means of traction.

I apprehend it does not lose so much power by its own locomotion, even upon soft and uneven ground, in large fields, as a rope does for such traction. I am aware of the immense advantages of steam over horse power in this country, and no one is more sanguine than myself of the practicability of the former for the cultivation of the land. It has been ascertained that the horses employed in agriculture, consume one-fifth of the whole produce of the land of this country; therefore, their displacement by steam is very desirable, and every effort should be encouraged tending in this direction. I am of opinion, that many of us may yet live to see it effectually carried out. The greatest difficulty is, that the number of patents taken out under the present patent laws, (good as they are) has a tendency to clog inventors. As an individual, or a single manufacturing firm, I do not contemplate such an undertaking. I should be pleased, indeed, to see it at once taken up in earnest by those who have more courage and means to carry it out to perfection. I will use no disguise or secrecy as to my ideas of the means to be pursued to the attainment of this object. I will only trouble you with a very brief outline of my ideas as to the difficulties we have to encounter, and the remedies I would suggest:—

"1st. The difficulty we have at present to contend with is, to apply our steam-power to our present means of turning the soil, either with a plough or any other effective tool; because we find that a plough is not adapted to a steam-engine any more than a spade is to a horse, and a rotary motion does not appear to me to be effectual at all times, or on all soils.

"2nd. That the weight of the engine to travel over the land is a difficulty as well as a disadvantage; and although it may be done by a rope, it must be admitted that the rope has its disadvantages.

"Let us, therefore turn our attention to the construction of a tool that will effect its work on all lands in seasonable weather, and capable of being adapted to the power of a steam-engine. This, I believe, may be done by constructing a number of spades that will turn the soil as near as possible like the hand-spade; then, place an engine upon these spades sufficient to work them, and, thus connected with its work, its weight instead of being a hindrance will be a decided advantage, and by such weight, in connexion with the ordinary action of the piston of the engine, the means of propelling and turning the soil will be more effectually obtained than with any horse-propelling implement. I do not think that it is difficult to give the action of the hand spade, through the motion of a common portable steam-engine. Its travelling wheels should be hung on crank axles, or by some contrivance to raise or lower the depth of cutting and of the spade, and to regulate the same. It should, however, only partially rest on its wheels when at work to regulate the depth of cutting, but entirely when required to raise its diggers out of the ground, or in travelling.

"If these brief remarks should lead any inventors to the prosecution of the object before us, my earnest desire is that they may go on and prosper."

Mr. **Robert Roger** says:—A few of the disadvantages of the fixed windlass system of tillage of land are as follows:—

"1st. The remoteness of the motive power and means of stopping, when any obstruction occurs to make this necessary, either in the course of working or at the headlands, and the great liability to serious breakage from the carelessness or ignorance of attendants, or the derangement of signals.

"2nd. The great amount of wear and tear on wire rope, from trailing on the ground, in addition to the friction from winding and unwinding on the drums.

"3rd. The liability to saw itself into the soil on hills, and to derange the working of implements by pulling straight across hollows, thus making it difficult to cultivate undulating surfaces.

"4th. Considerable delay must be necessary at each furrow or bout, from the stopping, reversing and again getting away with the engine.

"5th. A much greater strength of wire rope is necessary, from having the entire weight of itself to haul, the whole length of the field, in addition to the implements, thus requiring additional strength of windlass machinery and anchorage to meet this; in fact, in the plans proposed, I see no advantage whatever over that abandoned by the Marquis of Tweedale some years ago; I believe, principally, on account of the wear and tear of wire ropes. The friction of a wire rope working light, being no criterion for the friction when the drag of an implement is on it.

"6th. With the wire rope travelling as proposed by Messrs. Fowler and Williams, there is no provision for turning any implement about, so as to be hauled back in the opposite position,—I mean such implement as a grubber or scarifier;—neither is there any possible means of communicating a rotary motion to any other implement, should this, as I think highly probable, be found advantageous for summer tillage. The plough will long, I think, be found best for turning over the soils.

"I now beg leave to point out a few of the leading advantages of the Fisken's patent mode of tillage:—

"1st. The power required to overcome the resistance due to the driving cordage is extremely minute; I have seen a man set above a thousand yards, in addition to the engine, going with one hand, and with more apparent ease than he could move the engine in any other way. This Mr. Fowler admits, 'is very slight indeed.'

2nd. "The weight of the travelling windlass and ploughs combined, capable of turning two furrows at once ten inches deep, does not exceed sixteen cwt. Have Messrs. Fowler or Williams succeeded in making one to carry the ploughs with less weight?

"3rd. The complete control the attendant has over the windlass, so as instantly to stop or reverse its motion. This is of immense value in the case of roots of trees, stones, as well as at the headlands, or in hilly ground, where the plough may be out of sight of the engine man, thus avoiding any possibility of its being hauled to the sheaves at the headlands; as it might be where the motor is a distant power and under distant control.

"4th. The small liability to wear and tear of the wire rope; it being subject to no action but that of winding and unwinding from the drums, not even having to bear the strain of dragging itself about, it may be made so much lighter.

"5th. The facility of applying any rotary action or mode of operating that may be found advisable. Suppose, even for removing or raising large stones or tree roots, the whole power of the engine may be devoted to that purpose.

"6th. The simple, yet perfect mode of anchorage, enabling the attendant to apply the power of the engine to shift the anchor when not required for the tillage implement, at the same time giving a powerful windlass, available for placing any other implement, such as a drag or scarifier, behind the travelling windlass, thus obviating the necessity for horse or manual labour for that purpose.

"7th. The effective steering apparatus for placing the ploughs in position for new furrows, or turning the travelling windlass in front of any other implement.

"In conclusion, I am sorry my experiments have been so limited, from being entirely dependent upon others for a motive power. In a few days I shall have an engine completed, when I shall make a series of experiments with the dynamometer and pressure guage; if it is thought worth while, I shall be most happy to answer any queries on the subject you may think desirable; I may just state, in the mean time, that, with an inferior four-horse engine and two men, we have ploughed to an average depth of eight-inches at the rate of six acres in ten hours; this is, I think, fully equal to the work of twelve horses and six men, for an actual cost of from 15s. to 20s. per day."

Mr. J. A. Williams says, "having about four years ago purchased a portable steam-engine, threshing-machine, mill, and other machinery, it was not long before I was struck with the thought that it would be perfectly practicable to cultivate the soil by steam power, and that it would be done to great advantage, as the great reduction of speed from the engine to the ploughs would give a power for the draught of the latter, the cost of which, as compared with that of horses, would be an immense saving. From that time to the present I have given the subject all the time I could spare from my other occupations, and have at last succeeded in bringing out a machine, simple in its construction and practicable in its results.

"The first thing that I did was to consider the nature of the work to be performed, and the best and simplest mode of applying the power to execute the same. It was evident, that, taking the soil of the kingdom generally, a very large proportion of it (say three-fourths at least) was more or less undulating, and I was soon perfectly satisfied that this difficulty, together with the loss of power requisite to propel an engine as a locomotive, the adhesion of the soil from her weight, and the further power required for cultivation from this cause, completely settled the question as far as regarded the employment of a locomotive engine for the purpose.

"Considering the subject further, I felt convinced that we ought to make use of the ordinary farm engine, from 4 to 6-horse power, which was coming into such general use, so that when a farmer had got an engine and had not half sufficient work for her, by adding a ploughing machine to his stock of implements he could find full employment for her by cultivating his land. Again it would be advantageous to those who let out engines and threshing-machines to hire, if a machine could be constructed whereby he could find full employment by taking work by the piece of those farmers who had no engines of their own, at such times when two days' work are wanted to be done in one; and at all times, if it could be done at a price far below what the cost and maintenance of horses will allow their labour to be put at.

"Having condemned, in my own mind, the system of locomotion, I had to consider the best method by traction. Of the power possessed in an ordinary farm engine I had no doubt, but the difficulty seemed to be, the mode of applying the power, so as to draw the cultivating implement as evenly over the soil as a piece of ruled paper. I at last concluded that, as far as possible, the engine and machine should be stationary whilst doing as much of the work at one time as it could. There were two modes of doing this; the one to remain at one corner of the field until it was completed, the other (the one which I have adopted) by fixing the engine to the machine by a pair of shafts, similar to a horse in a waggon, and connecting to both a long table, punctured at every nine inches to admit the pin or shaft of a guide pulley and roller, so that each of the implements serves as a purchase for the strain necessary to propel the cultivators; and by these means I can plough the width of 40 feet without moving, when the engine will propel herself and the machine forward the required distance for continuing the work. In looking at the advantage and disadvantage of both these systems, the former seemed greatly in favour of the continued fixed engine, but considering that the field to be ploughed may be 20, 30, 50, or even more acres (for if we bring this system practically to bear, hedges and trees must come down, and pits must be filled in, to make way for us), the additional length of rope which would be required to traverse the headland, before it turned at right angles into its work, and the distance the work would be from the power (a great consideration when limited to a 6-horse engine), I decided in favour of the one to move along the headlands as required, but which was always close to its work. Again, I considered between the two systems, the friction or loss of power I should sustain by the number of pulleys requisite to work each. In the one I have chosen, I cannot (except when the line of draught is opposite the drum) do with less than two to each rope; one to turn the rope on to the table, the other a shifting guide pulley to direct the rope into the field, and which is simply and easily shifted, the number of furrows required, when the ploughs arrive at the end of the field. In the other, that of remaining at one end of the field until it was finished, I found I could, in drawing the implements towards the engine, do with only one pulley, and that one of much larger diameter; but with respect to the back draught, it could not be done without two, if not three; and, taking into consideration the cost of the additional length of rope required, the wear and tear of it, the loss of power to a certain extent, besides its weight to handle and transport, I decided for myself to keep close to the work. The system which I propose to adopt with respect to working a field, those who have seen my drawings for the patent, or the working model which I exhibited at the Farmers' Club House, in December last, will be fully acquainted with. To those who have not seen either, suffice it to say, that when drawing a cultivator, or any implement other than the plough, I propose to pull both ways, to and from the engine; to accomplish this, it is necessary to have some purchase on the opposite side, for which I have constructed a carriage on wheels, with one large pulley wheel fixed, and a moveable guide pulley, as at the engine; the frame is likewise punctured at every nine inches for the same purpose; a bell and signal, similar to a railway one, is attached to this frame and travels with it: this is its use—I was for a long time puzzled to know how the engineer was to ascertain when to shut off the steam on the arrival of the ploughs, &c., at the opposite end of the field, more especially if from the undulating position of the land the said headland should be out of sight; at last I thought of a bell and signal, which acts as follows:—on the conductor getting near the platform he leaves his charge; and rings the bell which is to call the attention of the engineer to the signal; the engineer then lays hold of the handle of the throttle valve, and looks to the signal, which is turned off from him, and as soon as the conductor gets his ploughs, &c., sufficiently close, he turns the signal, and the engineer shuts off the steam. I find that even at present, without much practice, I can stop within a yard of the place required.

"This system I shall invariably adopt when using a scarifier or cultivator of any description, but with the ploughs there is a difference, and until a perfect one-way plough can be obtained there must always be a hindrance at each lands-end of shifting the plough from the right-hand side of the land to the left. The next trial which I intend having will be on a totally different plan, but before I describe it it will be necessary for me to digress from this hauling subject and consider another connected with it, but still of a different nature.

"Amongst the thousand questions I have had put to me with respect to ploughing by steam, one was, 'What will you do when you come against a great stone.' My answer at first was, 'I must do as I can; either the stone must give way to the plough, or the plough must give way to the stone;' but it made me think whether an implement could not be constructed which would adapt itself to this difficulty, and I set about my object with the aid of the village carpenter and blacksmith. I took an old drill which I had, crooked the axle, and formed it into a square head. I then formed a rectangular frame, sufficiently long to carry three ploughs. I felt that to make them independent of each other it would be necessary that they should slip up and down vertical standards, and likewise they should move in a lever the same as a drill, that they might act for themselves when coming in contact with a stone. It struck me likewise that the machine must be self-acting, that it must *hold its own ploughs*. This I accomplished by placing vertical standards in the rear, which, working in a slot at the end of the beam, gives the ploughs a perfect independent vertical action, without allowing them to move to the right or the left. Suffice it to say, that after I had completed my implement, I found I had discovered *a perfectly new principle*, that amongst all our farm implements there was none of *a combined nature* that I had ever seen or heard of, *which was perfectly independent of the frame, or each other*, but were all more or less connected by a horizontal bar, and thus preventing their freedom. Those who saw the two implements which I exhibited at the Smithfield Show in December last, viz., the three-furrow plough and the cultivator, will probably remember the principle on which they were constructed, and I am pleased to remark that on trying the same three-furrow plough subsequent to the Show, in a field with two single ploughs, three horses in each of the single ones, and five only in the three-furrow one, and testing them with the dynamometer, that the draught on the three was considerably lighter, being upwards of one cwt., than three of the single ones, at the rate the two were drawing; and had there been six horses attached to the machine, they would not have drawn harder than the six drawing the two ploughs.

"Such are the implements with which I intend making my next trial, and I have four of them now nearly ready. I am going into the field without the back-hauling platform, with the engine and machine only. I shall have four 3-furrow ploughs, and draw two at a time, with the assistance of two horses if required, so that by employing four horses, two to each set of ploughs, I shall always have two plough frames, with the spare rope at the far end in readiness, that by throwing the drum just wound up out of gear, and the other in, to go on again without any loss of time or steam.

"At the time the engine begins drawing the plough at the far ends, the two horses next the machine are going back empty with the two ploughs which came up last, and drawing the next or its own rope out with it to be in readiness for the engine when the other traverse is completed. Thus I see no reason why any loss of time should occur, except whilst turning at the end and shifting the pulley (which is instantly done) to draw up the second plough frame, and to take out the rope for the next pull. Under this plan it might be said that it is not altogether steam ploughing, but that does not matter, as at present we have the horses, and the two working with the engine need not draw if not required, but where the power is limited, as I propose, for the sake of expense and weight, it is of consequence to employ all that power in the hauling alone, and it may be satisfactory to those farmers who still wish to stick by their horses, to see them still at work, and their own steam-engine (to use a common term in these parts) *pulling tag*. There will be another advantage in using horses. The sudden strains on the rope, when the power of the engine is exerted on the cultivators, can be taken off by the horses being made to exert themselves at the time the rope begins to strain tight; and again, they are ready without hindrance to turn the ploughs and take them back. With respect to the number of hands required in the field, as the ploughs require no holding, one man with each is sufficient. Whether they can drive the horses at the same time, remains to be seen and proved by practice, but I feel confident that it will, ere long, be completed as a system with despatch and economy."

Mr. MECHI said he had received a note from Mr. Usher, regretting his inability to attend, and stating that he was still continuing his experiments with the steam plough, and which were certainly not unsuccessful. The conclusion which he (Mr. Mechi) had come to was, that the moving of a heavy body over the land was a very desirable thing, but was not very likely to be accomplished by the method he had, in conjunction with Mr. Romaine, tried. However, they ought not to despair, for the horse was about the worst machine they could use in respect to cost. A horse weighed about 15 cwt., and 13 cwt. out of that had to be employed in propelling himself, 2 cwt. only, therefore, was profitably employed by the farmer, as shown by the dynamometer attached to the plough. He considered that some encouragement ought to be given to the inventors of steam cultivators, because from what he had seen he believed that however much agricultural locomotives were found fault with, they would not in the end be the cause of so much disappointment as was supposed by some persons. They were all perfectly agreed that a great deal of money might be advantageously spent for so desirable an end as cultivation by steam, especially when they considered that every horse consumed as much as eight human beings. If there were only a million of horses employed in agriculture, they consumed the food of eight millions of people. He ought to say that Mr. Atkins (the contributor of several drawings illustrative of the subject under discussion displayed in the room), in whom he had great faith as a mechanic of a superior order, exhibited the same drawings at his (Mr. Mechi's) annual gathering two years ago, though not under such favourable circumstances as the present. He quite agreed that if they could have steam applied to field cultivation, they must work at very high pressure. Allusion had been made to Mr. Collinson Hall; that gentleman knew a great deal about steam power, and was now working at the high pressure of 200 lbs. to the inch, and that favourably. He hoped we should not much longer see that extraordinary anomaly, that while locomotive engines are conveying us at express speed to all parts, at a pressure of 90 lbs. to 140 lbs. to the inch, the Royal Agricultural Society should tie down steam engines to a pressure of 45 lbs. to the inch. With regard to the form of the cultivator, the plough was not the best tool that could be employed for steam engines. In using Mr. Garrett's horse-hoe—ten or a dozen steel table knives with the handles bent up—a pair of horses could positively cut seven feet of ground to a considerable depth; whereas, with a plough, they could not plough more than nine inches. Mr. Romaine still continued his trials with his engine, and had got another patent. Notwithstanding the great difficulty in getting money advanced for experimental purposes, he hoped there would always be experimentalists, and that the benefits of those experiments would yet be fully experienced. The Society of Arts was doing an immense amount of good by raising the question then under discussion. The papers which had been read had suggested several new ideas, and in this great country, where everything was done by steam, he hoped they would soon see it brought to bear for the production of cheaper and more abundant food for the people.

Mr. SMITH (who exhibited a model of a new plough for steam cultivation, just invented and patented by himself,) said, the model he produced was that of an implement with which he had been making experiments for the last month. He had worked it with a seven horse-power engine, constructed by Messrs. Ransome, and a windlass constructed by the same firm under the direction of Mr. Fowler. The engine was stationary. By planting the engine in the centre of a 40 acre field, he found that by running out sufficient rope to do one part of that, he required 15 lbs. of steam from the engine to put the rope in motion, without moving the instrument. The power was conveyed from the engine by an endless rope by means of a windlass, to which, by two pulleys, a backward and forward motion could be given. The rope was supported from the ground on rollers, and when drawing the plough was quite above the ground. The engine, when working at 45 lbs. pressure, indicated seven horse-power. Working at a pressure of 35 lbs., it would cut a piece of ground 30-inches wide and 7-inches deep. He did 23 acres with that implement during the last month, and found that he could do 10 acres to the right and 10 to the left with only one shift of the tackle; and 40 acres could be done with only one move of the engine. The plough could be varied; they could go any depth upon that principle; it being only a question of a little coal and a little higher pressure,—they had no extra labour. He could do an acre in about 2½ hours. The rope travelled at the rate of about 1½ or 2 miles an hour. The cost per acre, allowing for wear and tear, was 8s. 4d. Four acres could be done within ten hours, at an actual cost of about 25s.; but if he allowed one-fourth for wear and tear, the cost per acre would be 8s. 4d., as previously stated. That was the result of the experiments he had made with his instrument, and it remained only for him to add, that a man could manage it without his (Mr. Smith's) assistance after the first two days, as well as he could manage a team of horses. The time lost in turning the plough was thirty seconds, sometimes, indeed, only fifteen seconds.

Mr. **Atkins** begged to thank the Society for the kind invitation to be present at that important meeting. Having devoted many years to the subject, and been at considerable expense in developing a plan, he thought he should be seriously neglecting his duty were he to fail in giving the public the little knowledge he had acquired in that direction. In 1843, he entered upon this investigation with the determination, if possible, to solve the problem of steam cultivation. After more than two years' efforts, he succeeded in bringing out a model worked under a patent taken by J. A. Atzlar, of America, which consisted of a process of transmitting power with ropes. The apparatus being complete, he took it to Shrewsbury, in 1845, and, being too late to get it introduced into the Royal Agricultural Society's show yard, he took Mr. King's auction room, and well posted the town and district, inviting the public to attend a lecture and examine the model. He must confess, he was somewhat astonished in the evening, as he had only two Russian gentlemen to attend the lecture. However, having already commenced the construction of a full-sized machine, he had the same completed forthwith. He put it in practical operation at Blackthorn, near Bicester, in Oxfordshire. The principle of transmitting power being established, it only became a question of time, when the application of steam to cultivation should be worked out into practical reality, and having watched its progress to the present day, he must confess he saw no difficulty in its immediate introduction to the public. The diagrams on the wall illustrated his ideas in the simplest form. They would perceive that the arrangement was carried on by an endless rope, and the rope carriers enabled the ropes to adjust themselves on level or hilly land, by the balance weight in the centre. The engine and the rope carriers might be moved on their own wheels by a temporary wooden railway. The space between the carriers and the engine might vary from 50 to 1,500 yards, thus enabling the machine or rotary cultivator to work up and down the land without any obstruction. He believed, on examination, this arrangement would be found of a most simple and inexpensive character, and as 1,000 yards of land might be cultivated with ten cwt. of rope, with a 20 or 25 horse-power engine, he could not understand why a subject so simple might not be put into practical operation. He had devoted more than £1,000, and from two to three years' labour to bring out the idea, and he thought it was to be seriously regretted, that the engineers of this country had not paid more attention to this important subject. He would be glad to co-operate with any party who might feel desirous to make a bold effort to solve the problem. He felt certain, that should a Committee be formed, and an appeal made to the British public, it would be attended with every success. For his own part, he would only say, he would be quite happy to co-operate with such a Committee, and endeavour to bring this subject to a practical realisation. If a subscription should be opened, he would be glad to contribute his quota, as he was only waiting for some effective steps to be taken.

Mr. J. M. **Blashfield** remarked, that the letter written by Mr. Adams, which had been read by the Secretary, referred to some of the main points of difficulty to be overcome in the first stage of proceedings to plough by steam. One of these difficulties was to provide a shoe, or rail, upon which the engine should traverse, so as to prevent the wheels of the locomotive from sinking into the soil. At present, all the steam-engines used for agricultural purposes, and engines of the same class used for railway making and dock works, are constantly sticking fast from the sinking into the soil of the wheels which carry them. The ploughing engine should be a perfect locomotive, and move itself as well as plough the soil. To do this effectually, a rail and sleeper should be brought beneath the wheel of the engine—that is, the engine should lay down for itself to run upon, a sleeper and rail, and at the same time take it up as it performed its duty. This might be effected by an endless chain of sleeper and rail constructed from the axes of the driving wheels of the locomotive, or working by a ratchet or other contrivance attached at right angles to the inner side of the periphery of the driving wheel of the engine. Such a mechanical arrangement of sleeper and rail might possibly be devised as to work obliquely by an oblate movement rotating on friction balls or rollers. He (Mr. Blashfield) remembered having seen, somewhere in the North of England, a truck, of the sack-barrow character, having a shoe like the folds of revolving shutters for the wheels to run upon on loose ground. These folds of iron revolved with the wheel, and were attached to the axis of the wheel. Locomotive engines of a portable character had been long used for railway, dock, and canal making, but were, for the duty they had to perform, stationary; the defect of proper means to move them from one spot to another had always been felt by contractors, as the wheels readily buried themselves in loose soil. He (Mr. Blashfield) had witnessed the experiment with the American machine for excavating ground, which had been tried on the Great Northern Railway, and the difficulty of bringing it to its point of attack, or place of work, and the joy and exultation expressed by the navigators upon this difficulty. He was convinced that no operation of steam ploughing would be perfect until the engine should make its own roadway, as well as perform its agricultural labour. The same machine that did this would be of great value in forming railway levels, docks, canals, &c.

Mr. T. **Scott** said, it appeared remarkable to him, and was creditable to the disinterestedness of Mr. Fowler, that he had touched so slightly on the merits of his own invention, although there was little doubt but that it was the wonder of the day, and would in after years be considered *the* invention of the age in connection with agriculture. It appeared to him unquestionably to have given us the basis of steam cultivation, for it had settled the principle and cost of an adequate motive power, that being a stationary portable engine, a few simply arranged and easily adjusted blocks, a windlass, and a wire rope. A ten-horse-power engine under this arrangement could give a slow motion to a machine—for instance, Mr. Fowler's draining plough—requiring one hundred horse-power to move it. Now, suppose the speed of the engine was doubled—say to a good ploughing pace of two miles an hour—and the power thus reduced one half, or to that of fifty horses, and that we took Mr. Fowler's estimate of the loss of power by friction and in drawing the rope. Here we had a clear forty-eight horse-power remaining to draw say twenty common ploughs, or a relative number of other implements. It would thus be seen what an invaluable power this gave us for deep cultivation. Here, then, we simply wanted mechanical adaptation to a special farm or district. But then came the question, who was going to pursue this slow and expensive process of mechanical adaptation further? Mr. Atkins, who had made the nearest approach to realisation, said, he would go no deeper in the mire, having "spent his last penny." Mr. Fowler, too, said, he had made up his mind how much further he would go, which need not create much uneasiness in the agricultural mind, as he was now within sight of the winning goal, having realised an article the value of which, as a commercial speculation, would now induce others to join him. But, what was the case with every other inventor? Their ideas were probably matured, but their mechanical embodiment was in embryo, and their means were gone. If Mr. Atkins was an index to this class of inventors, the dividend seeking public would not join in bringing out their machines. Would it not, therefore, be politic that we should have a national experimental farm, under two or three highly competent commissioners, to put all such inventions to the test and report upon them? Such an institution was suggested to the Highland Society of Scotland twenty years ago, by a practical farmer, and not unfavourably received. As he saw Mr. Fisher Hobbs present, he would ask him, as one of the Council of the Royal Agricultural Society of England, if he thought such an institution would trench on the domain of that Society. He should not discuss the relative merits of digging and ploughing; suffice it to say that there was no necessity for an engine employing the greater part of its power in carrying its own weight over the field; nor was there any chance of its being able to do so at a profit. He had seen Mr. Jasper Rogers' celebrated locomotives for common roads stopped by a little fresh macadamising. Mr. Mechi had stated in detail how a horse's muscular power was expended, and how little was left for labour after what was expended in dragging his own body about. Wire rope, as Mr. Fowler had shown, had lessened the necessity for travelling engines, and Mr. Fowler had satisfied him (Mr. Scott) by carefully recorded experiments with his machinery, that motive power could be obtained by it at an average cost of one half that of horses. This pecuniary consideration was much more likely to induce the adoption of steam cultivation than the economic crotchet that it would save the food consumed by the million of horses now employed in agriculture, for the use of the people. The present cost of horse flesh, as well as all kinds of provender, would no doubt excite increased attention to the subject discussed here to night. As a practical agriculturist, he (Mr. Scott) thought its necessity was becoming as evident as its application to well arranged farms was feasible; and, although there appeared no immediate prospect of its realisation and general adoption, he could not help saying, as Mr. Mechi had done on another occasion, that "his hope was in the future."

Mr. **John Bethell** could not allow the evening to close without saying a few words, as his name had been mentioned in the course of the discussion as one of the inventors who had spent his money for the benefit of the human race without deriving any himself. He represented the class of inventors who seemed to have found little favour that evening. His invention was one for cultivating the land with a steam-engine which was locomotive. The digging apparatus was attached to the engine itself, and the engine was fit to be used for all the other purposes of a farm when not required for digging. At first he thought it was a very simple thing, but on bringing his machine into the field he found numerous difficulties. He had been working it for three years with various alterations, and had spent a great deal of money upon it, but he had at last succeeded, and had just ordered drawings to be made for the construction of a new engine, as the field was still unoccupied, for they must admit they had seen nothing that evening which could be represented as a perfect steam digging or cultivating tool. He was unable to lay before the meeting all the details of his plan. He could only simply state that in principle it was the same as was described in his patent of December, 1852—a rotatory digger. It dug like Parkes' steam forks, and left the ground in a perfect state of tilth after the operation; it threw the earth up into the air, the earth falling first, because the heaviest, and the weeds coming upon the surface. They had no difficulty in working about four or five acres a day with that machine. It dug down to the depth of nine inches, and farmers who had seen it working had stated that it did as much in one operation as would require two or three ploughings to perform, besides scarifying, harrowing, &c. The estimated cost of its working was about 9s. an acre, whereas 28s. was stated to be the cost under the ordinary mode. The experimental engine was worked at a pressure of 45lbs., but the one he was about to construct would work as high as 100lbs. to the inch.

Mr. **Fisher Hobbs** had not intended to make any remarks that evening, but as his name had been mentioned in connexion with the Royal Agricultural Society, he felt it his duty to state that that Society had, for a long time, had under its consideration how the question of steam cultivation could be best promoted. He was happy to say, that a short time since arrangements had been made by the Society to offer a premium of £500 for the best steam cultivator, which would turn up the soil, and become a substitute for the plough and the spade. Knowing as they did that horse power cost them in ploughing £1 per acre, it was clear that if it could be done for less, a very considerable saving would be effected to the country. When they looked at the small amount of the income of the Royal Agricultural Society, not exceeding £5000 a year, they would at once see the importance they attached to this subject when they set aside one tenth of their income to promote it. He thought that even if the Government or Parliament would not take up the subject the public might subscribe such a sum as would assist agricultural engineers and others in making experiments to bring steam cultivation to perfection. He had only made these remarks believing it to be his duty to inform them that in such a movement the Royal Agricultural Society was ready to do its part.

The **Chairman** said, it was evident, from the information thrown before them that evening, that for a very long period much attention had been given to this important question, and that something like 60 patents had been taken out in connection with it. It was also very certain —and quite within the pocketable experience of several individuals in that room—that the experiments they had individually made had been attended with a fearful expenditure of money; and for all that expenditure of time, of talent, and of money, it was well to consider to what they had already attained. It was still a question upon which of the various systems there appeared to be most hope of ultimate success, and there appeared to be a fair chance that each might be fairly tried out. Some advocated the original idea of the locomotive travelling over the land and dragging after it the implements in present use modified to the novel purpose; of that class Boydell's steam-horse was an instance. Some contended for a locomotive which should, as a part of the same machine, convey rotatory motion to a new class of implements, by which the soil should be broken up and pulverised; of that class were Usher's and Bethell's. A third party was endeavouring to effect the object by fixed engines, or by portable engines to be fixed in one spot of the field, from which motion should be communicated to rotary machines or cultivators—as exemplified in the system of Mr. Atkins. And a fourth was sanguine as to the results to be obtained from using the general agricultural steam engine, to be fixed in a given spot, by means of a system of ropes working round pullies, by the intervention of a windlass, to draw the ordinary implements, or any suitable modification of them, in straight lines across the field; of that class the experiments of Mr. Fowler and Mr. Smith gave the most evidence of practical success. He (the chairman) did not pretend to give a decided opinion as to which of these systems might ultimately prove the best, but he was strongly inclined to believe that, following out the principle of the use of the present agricultural engine, and the system of ropes and windlass, would lead with the least cost to the earliest development of a practical result. He believed it possible that at some future time the more elaborate plans might be developed to a still more perfect result; but that was not to be obtained until after a long and expensive series of experiments, while the simpler plan would, he believed, show its practical results at a very much earlier period; and the experiments might be conducted by a number of persons who, having steam engines, and requiring no great outlay for new implements, might, without any ruinous outlay, attain a practical and beneficial result; and when once such result should be attained and made public—that by any method steam cultivation might be so conducted as to effect a saving over the use of horses, even if such *method* should not be so perfect as others which might ultimately be developed, great encouragement would be given to stimulate further improvement. He agreed with Mr. Atkins that there existed no difficulty in a mechanical point of view. He did not believe in any engineering difficulty, except the lack of funds, and that was the great difficulty in the present case. The cost of bringing new inventions to bear, was at any time great, but especially great when the introduction of the invention involved, as did that, the accompanying introduction of a new system. It was too costly an experiment, and the beneficial return for that certain cost was too uncertain and too remote for unassisted private enterprise. The remarks they have heard that evening, from those who had made considerable advance went to prove that the time sooner or later was sure to arrive when hope of profit faded, and patriotism was not strong enough (unless, like some of his friends on his left, they had the heart of a lion, and a pocket deep as a well), to induce the further prosecution, always so costly, and sometimes so ruinous. There was no doubt but that steam cultivation might be brought to bear, but it could only be developed by large and costly experiments, and these could only be successfully carried out by some general fund, as they could not be accomplished by individuals excepting at a severe loss, and, in many cases, ultimate ruin. He had now only to move a vote of thanks to Mr. Fowler, not only for his valuable and interesting paper, but for his enterprise, assiduity, and long devotion to the subject. It had only been by the most unwearied exertion, zeal, and talent that he had been enabled to bring his valuable invention to bear. He hoped and trusted he would receive that reward in full which he so well deserved, and which had hitherto been denied to others; and that having proved the advantage of his machine on one branch of the subject—that of draining—he might go still further, and perhaps be the first to prove that the extension of steam to general tillage was less remote than had been generally supposed.

Mr. FOWLER thanked the company for the compliment. There was one part of the subject which had been but briefly alluded to—the conveyance of engines from one part of a farm to another. Mr. Boydell had invented a means of readily doing so, upon which further experiments ought to be tried. Mr. Fisher Hobbs had alluded to a public fund for the purpose of making a series of experiments, with the view of ascertaining the best means of applying steam to the cultivation of the soil. He would ask that gentlemen whether the Royal Agricultural Society would take the initiative in raising it. If they would only hold up their little finger for the purpose, he felt assured they would have no difficulty in raising £15,000 or £20,000. They had only to use their influence, and he was certain the public would readily respond to the call.

Mr. HOBBS could only say that he would be happy to bring the subject before the Council of the Royal Agricultural Society. He considered that that Society had never been supported as it ought to be, and that it only required the means to enable it to make most important experiments for the good of the country. He felt with Mr. Fowler that they ought to have an income of £15,000 or £20,000, and if so they could enter upon inquiries which would much benefit the agriculturist and the country.

The Secretary announced that there would be no meeting on the evening of Wednesday next, it being Ash Wednesday. Also, that on Wednesday, the 13th of February, the Paper to be read was, "On the Manufacture of Crown and Flint Glass," by Mr. Henry Chance. On this occasion Mr. Apsley Pellatt, M.P., will preside.

EXAMINATION OF MEMBERS OF CLASSES IN INSTITUTES.

The Council has appointed a General Committee of Examiners for carrying into effect the Society's plan for examination of members of classes in Institutes, followed by the grant of certificates.

Due notice of the details, and the time of holding the examination, will shortly be given in the *Journal*.

SURPLUS FROM PATENT OFFICE FEES.

The following letter, from Sir Joseph Paxton, M.P., was recently laid before the Council, who resolved that it should be referred to a Committee to consider and report thereon, and that the gentlemen whose names appear in the subjoined list should be requested to serve on that Committee:

Rockhills, Sydenham, 3rd January, 1856.

SIR,—As a Vice-President of the Society of Arts, permit me to invite the attention of the Council to the large and constantly increasing revenues derived from the fees paid by inventors for letters patent, and to the mode in which they continue to be misappropriated. It will be recollected that at the last annual dinner of the Society, I referred to this important subject, and I now revive it, because I think that the time has come when it is necessary to take active steps in the matter. The Council is aware that after paying all expenses and fees connected with letters patent, a very large annual surplus arises, which, according to the present arrangement, will be absorbed by the treasury. According to the Report of the Commissioners there were, in 1854, 2,764 patents applied for, and 1,912 sealed, the fees and payments thereon amounting to £53,000. After deducting from this total £8,600 for the law officers of the crown and their clerks, £4,500 as compensation for abolished offices, £3,600 for salaries, &c., in the Patent Office, £4,400 for rent, stationery, &c., and £16,300 as the balance due from the previous year on an extraordinary outlay of £42,000 on the printing of specifications, after, I say, deducting these sums, there still remained a surplus of £15,600.

Now take this present year—of course the Commissioners' report upon its results has not yet appeared, but we know that the total amount of fees payable for patents will be greatly increased—the applications will be about 3,000 in number, and, allowing for a proportion not proceeded with, the total payments may be computed at £60,000. Then, bear in mind that, although under the new law the first cost of a patent is only about £25, to maintain it £50 must be paid at the end of the third year, and £100 at the end of the seventh year. The payments to be made on patents granted in 1852 are now falling due, and calculating that 700, or about one-third of the original number, are considered worth maintaining beyond the third year, there will accrue in this way, during the present year, an increased revenue of £35,000.

Again, supposing that 300, or rather less than half of these, are allowed to lapse at the end of the seventh year, for the 400 that remain there will be a further increase in 1859 of £40,000 per annum. Thus then, without calculating on any probable future increase in the number of patents granted, we seem fairly entitled to estimate the prospective gross revenue from inventors at £95,000 until 1859, and £135,000 afterwards.

This is so enormous a tax upon the ingenuity of the country, the last thing which ought to be oppressed by fiscal restrictions, that in my opinion the attention of your Society, and of patentees generally, should be at once drawn to it, in order to procure a great diminution in the scale of charges for securing patent rights. But even if it is considered that the present scale is not burdensome to individuals, or injurious to the general progress of invention, I submit that there is wide scope for amendment in obtaining such an appropriation of the large surplus which must remain, after deducting all expenses, as will preserve it for the benefit of inventive genius throughout the country, and prevent its being absorbed by the treasury. In order to bring out this point more clearly, let us suppose that the gross revenue of the patent office is accurately estimated at £95,000 till 1859, and at £135,000 from that date.

Taking the accounts of the Commissioners for 1854, it will not be difficult to deduce from thence the probable expenditure, so as to estimate what the net surplus is likely to be. Reckoning the number of patents applied for at 3,000, and the payments computed as above at £60,000, the fees to law officers of the Crown and their clerks would amount to something like £10,000, the salaries of all the officers and clerks in the Patent Office to £4,500, the compensation for offices abolished to £4,500, and the expenses of printing specifications, &c., to £12,000. This makes a total expenditure of £35,000, leaving upon the estimated gross rental of £95,000, as already stated, an annual surplus of £60,000, which will rise to £100,000 in 1859.

Supposing for a moment the foregoing estimate of expenditure and surplus to be taken as it stands, it never could have been intended by the legislature that a direct tax of £100,000 per annum, or even £60,000 per annum, should be imposed upon patentees for the general purposes of the state. A tax to defray the cost of the Patent Office, and give it any amount of increase desirable for the progress of invention, everybody would comprehend, but to place pecuniary obstacles of an unnecessary and burdensome character in the path of discovery and improvement, already sufficiently strewed with difficulties, is upon the very face of it, an unspeakable folly. The title of our Society, assigned to it by charter, has ceased to be appropriate, and the arts, manufactures, and commerce of the country have long since assumed dimensions which enable them to dispense with "encouragement" from any body of men, however zealous, enlightened, or influential. But it does appear to me that we can still do much good, by concentrating attention and bringing opinion to bear powerfully upon such questions as that which I am now endeavouring to place before the Council. I consider that the Society of Arts is bound to exert itself in rescuing this annual surplus from the hands of the Treasury, and I will endeavour to point out not only how in my opinion the money should be applied, but how the Council should proceed in the matter if they concur in my views. Before, however, doing so, it is requisite to point out that the charge upon inventors for securing their patent rights should not exceed what is requisite for maintaining the Patent Office in such a state of efficiency as to make it worthy of this country and to get out of it the utmost possible amount of benefit for those who devote themselves to scientific and practical discovery. I cannot bring myself to think that so large a sum as £100,000, or even £60,000 per annum, of clear surplus, is at all necessary in addition to its present working expenses, in order to give the Patent Office its proper development. Therefore it follows that a very considerable reduction can be effected in the present scale of charges upon patentees.

It is only recently that any serious and worthy efforts have been made to introduce something like order and classification into the Records of the Patent Office, to prepare a good and accurate series of indexes and other facilities for reference and consultation, to open up relations with similar establishments in other countries, to form an industrial library, and to provide at convenient points, not only throughout the United Kingdom, but in the colonies, the means for enabling every man who thinks that he has made a useful discovery to ascertain whether it really possesses the novelty which constitues claim to the exclusive use of it for a limited number of years. Through the liberal interpretation of their duties by the Patent Commissioners, and the valuable labours of Mr. Bennett Woodcroft, their superintendent of specifications, the foundations have been laid for the accomplishment of these objects, and it is obvious that they come fairly within the scope of what persons seeking patent rights may be expected and asked to pay for. I contend, indeed, that much wider ground should be taken than is at present occupied in this way, and that it is disgraceful to us, as a nation, dependent upon our industry and skill for our power, that we should have nothing better to show as the head quarters of British invention than the establishment in Chancery-lane. In an age which boasts that beyond all others, it desires to recognise and do honour to the peaceful arts, can we justify to ourselves the indifference which we have shown to the reputation and fortunes of our great discoverers, men who have conferred more lasting benefits upon their kind than kings or conquerors? I should like to see the Patent Office a place where such interests might be suitably conserved, where the original models of inventions like Symington's steam-engine might be collected, and where our posterity might trace in a great gallery the outward forms and lineaments of those master minds upon whose labours the vast fabric of modern industry mainly rests.

It appears to me, that the body in the Council of which the scheme of the Great Exhibition of 1851 originated, and was elaborated, is better fitted than any other to bring to bear upon the Commissioners of Patents, upon the Government, and on the legislature, such a pressure of influential opinion as shall compel the adoption of those improvements which I have thus indicated in general terms. I have merely sought to open up the subject, to point out the danger of the treasury acquiring a vested interest in a surplus revenue more than sufficient for the great objects of enabling invention to take its flights from the furthest verge of realised discovery, and of securing to it those hardly-earned rights of which it has hitherto been so remorselessly plundered on every hand. It has long been the custom of eminent men to complain of the want of State encouragement, but here will be their true endowment—one resting on the strong basis of public utility, and which all who really deserve it may enjoy without any sacrifice of independence on the one side, or any chance of favouritism on the other. Supposing the Council to concur in the views which I have advanced, I would leave it to them to consider how best they can bring the influence of the Society to bear in accomplishing the objects sought for. It seems, however, to me, that they might take steps to bring together as large a number as possible of the patentees in London and the country, and concert with them what ought to be done. The Commissioners of Patents are entrusted by the legislature with large powers, and what is required is to get them to use these powers as may be best for the interests of the patentees and the progress of inventions.

I have the honour to be,

Your obedient humble servant,

JOSEPH PAXTON.

LIST OF GENTLEMEN REQUESTED TO SERVE ON THE COMMITTEE, WITH POWER TO ADD TO THEIR NUMBER.

W. Bridges Adams.
John George Appold, F.R.S.
W. G. Armstrong, F.R.S.
Francis Bennoch.
Samuel Holden Blackwell.
J. M. Blashfield.
John Braithwaite.
Jacob Brett.
Joseph Burch.
F. Crace Calvert.
Dugald Campbell.
Robert Lucas Chance.
Edwin Clark.
Henry Cole, C.B.
Charles Cowan, M.P.
Frank Crossley, M.P.
Thomas De la Rue.
Bryan Donkin.
William Ewart, M.P.
William Fairbairn, F.R.S.
Benjamin Fothergill.
Sir Charles Fox.
Dr. J. H. Gilbert.
Joseph Glynn, F.R.S.
Prof. Graham, F.R.S.
Peter Graham.
Warren S. Hale.
Henry Hensman.
John Hick.
Edward Highton.
A. C. Hobbs.
S. C. Homersham.
A. H. Houldsworth.
Edward Humphreys.
William Hutt, M.P.
Owen Jones.
John Bennet Lawes, F.R.S.
George Lowe, F.R.S.
Sir John Macneill, F.R.S.
Henry Maudslay.
Charles May.
J. E. Mc Connell.
John Joseph Mechi.
Herbert Minton.
G. F. Muntz, M.P.
Robert S. Newall.
Thomas Page.
Sir Joseph Paxton, M.P.
John Penn.
Ainger M. Perkins.
James Platt.
Richard Roberts.
Titus Salt.
Charles W. Siemens.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
J. D. Morries Stirling.
Colonel Sykes, F.R.S.
J. P. Brown Westhead.
Prof. Wheatstone, F.R.S.
Joseph Whitworth.
George Fergusson Wilson, F.R.S.
Edward Woods.
Matthew Digby Wyatt.
T. H. Wyatt.

Home Correspondence.

PATENT LAW—PRELIMINARY EXAMINATION.

7, Duke Street, Adelphi,
Jan. 4, 1856.

SIR,—It may perhaps not be uninteresting to some readers of your valuable *Journal* to hear a continental voice raised on the important question of a *Preliminary Examination of Inventions*,—a question which at the present time occupies in no small degree the minds of the industrial world in both hemispheres. Allow me, therefore, to address to you these lines, which are less authorised by an extensive and long experience in the matter than by a perfect freedom from bias, and wholly dictated by a wish to impart a little knowledge to others, even at the risk of contradiction from the better informed or more enlightened.

The importance, nay, the existing necessity of a special legislation to secure the same protection to industrial as to any other property, has been generally acknowledged and acted upon by commercial nations. Its exigence, indeed, is so great that those countries which have refused to recognise this truth are standing on the lowest scale of modern civilisation,—a civilisation the general tendency of which is to attain the highest degree of well-being under certain given circumstances. Indeed, which are those countries where these characteristic features of our epoch are mostly to be met with? Evidently they are the United States, Great Britain, and France. All other countries either live, as it were, by loans; follow with more or less ill-will those three great examplars; or, lastly, throw their quotum of genius into the only remunerative market which the world affords, that offered them by those three countries. We shall, therefore, select these States in preference to others, in order to consider the different views of the legislature on so important a topic.

In these three countries the principle of patent-right is equally recognised, and has been acted upon, with some slight modifications, for nearly the same number of years; herein, however, exists the only analogy between the three legislations, and a striking contrast soon appears. Whilst in the United States, the classical country of equality, and inhabited by an ardent, go-a-head people, inventors are obliged to submit their creations to a costly, and in many respects, barbarous scrutiny, the slowness of which can only be corrected by an ever vigilant free press, Great Britain, the land *par excellence* of distinctions and separation of classes, pays an unvarying homage (although surrounded by antiquated forms) to men of genius of whatever origin, and requires from them nothing more than good faith in their applications for protection. France follows the same course, or rather she set Great Britain the example in 1844, whilst the present English legislation traces its origin to 1852, (abstracting of course the different forms, which are rather of an administrative than a political nature). The French legislature, however, with a frankness thought superfluous by the English, marked every undistinguished invention with the enigmatical letters, S. G. d. G. (without guarantee of the Government).

We thus find ourselves in the presence of two systems, the one followed by the Americans, establishing a preliminary examination; the other, English-French, rejecting it.

Now, though in philosophy, poetry, and mere matters of speculation a man may be permitted to be an eclectic, in the prose of life and in everyday pursuits it seems to me highly essential that no one should *loiter by the way*, but pursue steadfastly a given direction. Thus in patent matters we must decide for or against a preliminary examination; we must settle whether or not absolute free-trade principles are to rule the productive and inventive genius of our times. In other words, which of the two systems is preferable—the American system, restrictive, but at the same time presenting more security and guarantees to the patentee, or the French system, which is free from restraint, but, on the other hand, refuses from the very outset every guarantee to the applicant. In putting the question in this way the choice does not present any difficulties, but, as in many things easy answers involve great interests, so in the present case, I think it necessary to investigate the matter a little more closely and as it were historically.

Why has the American legislator thought differently on this subject to his colleague in Europe? In that vast continent, where freedom of action almost equals that of speech, where the democratic element has plenty of elbow-room in the senate as well as under heaven's canopy, unlimited freedom in industrial matters would appear by far more natural than the somewhat continental control actually existing there. And a directly contrary reflection presents itself with respect to France, the country *par excellence* of administrative control, supervision, and bureaucratic drudgeries. This divergency of opinion of the respective legislators reposes rather in the political and social state of the two countries than in the essence itself of the matter. The Americans submit to that kind of control from above because they are an essentially practical people. They are sensible how much it is for the general interest to keep within certain bounds that feverish heat, that high pressure which works their social body,—a body influenced by tradition, but full of heterogeneous elements. Would a settler in Ohio or wild Kentucky, who happened to *believe himself the only and true inventor* of a plough, or a reaper, or a sewing machine, and who had patented the same and saw his neighbour work the invention, would he like to lose his time, which to him is money, by going to law to dispute and settle claims in the ordinary way? I think the chances would be two to one for his taking the law into his own hands, and forcibly putting down that which he sincerely believed to interfere with his own rights. Thus the legislator would have the pain of witnessing a civil suit transformed into a criminal action.

Now all these inconveniences disappear before a preliminary examination, enlightened by a sound public opinion. The inventor's right of priority thus firmly established on legal ground, and the seal of novelty and utility impressed on each invention, by a freely recognised authority, constitutes, as it were, a bill of exchange drawn on the public, which the latter but rarely protests. Herein resides the wisdom of American jurisprudence.

I shall now proceed with the investigation of the subject with respect to Great Britain and France.

And beginning with the latter country, we find things managed in a somewhat different spirit. Indeed the French nation, whose eminently chivalrous and generous spirit rejects all that is exclusive, or might approach to egotism, could not, till lately, conceive the idea of such an exclusive property as that conferred by a patent. Even now, how many people are there in that country who can only perceive in a patent a sort of monopoly or privilege granted to an individual to the injury of the *many*. Thus, until recent times, the watchword (politicians know well its meaning) has been, "War to Patentees," "War to Monopoly," "Down with Barriers." Can it, then, be wondered at that the legislator of 1844 but timidly solved the question by taking away with one hand what he seemed to grant with the other. Thus it came to pass that while granting to inventors a protection of their property (!), he whispered into the ears of those who cried out against a so-called monopoly, "Don't be afraid; you see plainly my friends I do not guarantee anything; I only want to give you sport by starting a stag; 'Hallo! fall upon him!'" Since that time the pack has been opened in France, and more than one stag hunted down because of those horns which were once the pride of his lofty head.

Here I must stop. The subject is of too grave a nature to admit of pleasantry. It is evident that the present state of things in France, with respect to patents, cannot last long, unless the maxims of prudent legislation be entirely neglected. The late Exhibition at Paris has shown with prodigality that the industrial genius of France has taken a stupendous flight. Let the nation beware lest this genius be cast down on a burning sand, or be tempted to wing its adventurous course to more hospitable regions. It is true the times of the edict of Nantes are gone, but it is not yet impossible for human frailty to devise other edicts not less fatal.

The way in which the matter is looked at in Great Britain leads to a kind of *juste-milieu* between the American and French systems, and thus seems to offer a corrective of the vice inherent in the non-preliminary examination. It is true the proud and jealous spirit of self-government which animates the descendants of the rude Saxons in these islands, has removed from the subject every control excepting that which concerns legal formalities. The British government does not, any more than the French government, guarantee the security of property of rights in an invention. But the following are the advantages which the English legislation seems to have over the French legislation:

I. Government does not stigmatise an invention with the cabalistic letters S. G. d. G. (Sans garantie du Gouvernement); as if there were inventions that *are* guaranteed by government.

II. The legal guarantee is extended on the simple ground of there being no priority.

III. That priority may be easily ascertained through the public registers at the Great Seal Patent office, and the official publications of the Commissioners of Patents, including the printed specifications of all previous protested inventions, which it is declared by Act of Parliament shall be deemed and taken to be *primâ facie* evidence of the existence and contents of the documents to which they purport to relate in all courts and in all proceedings relating to letters patent.

IV. If on the one hand government trusts in the good faith of the inventor applicant, who states himself to be the *first* and *true* inventor; on the other hand, it provides him with the necessary means to make his invention quite safe by a *personal* investigation of the *official* works which record all that has been done by his predecessors.

From these remarks, the conclusion may be drawn that with respect to Great Britain the inconvenience of a non-preliminary examination disappears in a great measure, if not altogether, since every inventor, by asking for a provisional protection for six months, may between the date of his application and the time limited for sealing his patent, obtain a legal certainty that he had no predecessors or rivals in his invention, and, therefore, that the latter is quite safe against any prosecution for infringement. The bill of exchange spoken of with respect to the United States, may thus be obtained by inventors in Great Britain,—a country where the respect of property under all its forms is only equalled by the inviolability of law with all its oddities.

I remain, Sir,
Your obedient servant,
A. TOLHAUSEN.
Sworn Interpreter at the Imperial Court of Paris.

CORT'S INVENTIONS.

SIR,—I beg in a few lines to correct some inaccuracies in the particulars hitherto published of Mr. Cort's ruin by the Navy Pay Office. After the publication of my pamphlet on the matter, I received a friendly suggestion that reference to the details of Lord Melville's impeachment, in 1806, for his prolonged private appropriation of public funds, in his office of Treasurer of the Navy, might throw more light upon the original outrage on Mr, Cort, and the subsequent false verdict of the Committee of 1812, than appeared to be shown by the papers so long buried in his family. A search through the extraordinary Parliamentary transactions respecting the Navy Board has indeed thrown a light, which magnifies the Cort case to swelling dimensions. The defalcations of Mr. Jellicoe form a prominent topic through the whole investigations of those gross affairs. It is not often that the ignominious insects of official corruption have the privilege to be embalmed for all ages in the bright amber of beneficial and enduring invention. The deeds of the eminent firm of Trotter, Dundas, and Co., will now be *carried by rail* to the remotest posterity. It would be improper to load your space with details as comprehensive as they are atrocious; my object is to correct some of those which have already appeared, as an imperative justice, for no knowledge can be traced in the Cort documents of the *political* reasons for the inventors destruction. It seems, in the first place, that Mr. Adam Jellicoe was not the partner of Mr. Cort, whence I conceive that the extent in aid upon Mr. Cort's effects was an illegal act. The partner was his son, Mr. James Jellicoe. Secondly, the defalcations were *not* revealed by Mr. Jellicoe's decease. They commenced under the treasurership of Mr. Ellbore Ellis (who left office with an unsettled balance of £300,000 against himself), and were carried through two subsequent treasurerships, with the treasurership of Mr. Dundas, commencing in 1784, when, with an affectation of purity, he promoted the framing of an act for regulating his office, which gave him the precedency and presidency of defaulters, for it was impossible, without his own neglect of his own act, that defalcations could exist except by his sanction. His first act upon entering the office as treasurer was to procure Mr. A. Jellicoe to sign a cheque for £10,000, as if for stores in his department, the proceeds of which Mr. Dundas privately appropriated, and refused to account for. It was impossible to fix the treasurer and his accomplice, Mr. Trotter, with the exact date of their first knowledge of Jellicoe's misdemeanours, in consequence of the notorious release they mutually executed upon leaving office, to prevent either of them peaching upon the other, on which they agreed to destroy, and accordingly destroyed, all the books and vouchers representing the expenditure of £134,000,000 of public money passed through their hands. But Mr. Trotter admits to having known the state of Mr. Jellicoe's balances for *some years*, and Lord Melville knew it at least a year before the extent, for in 1798 Mr. Jellicoe placed in his hands as a security for the deficiency, the patents and contracts of Mr. Cort, and in a memorial presented to the Lords of the Treasury, immediately after Mr. Cort's decease, in 1800, petitioning for an *advantage to himself* for the *very beneficial invention of Mr. Cort*, he excuses his laxity in this defalcation, on the ground of the hope he entertained *that a Parliamentary reward would be granted to their extraordinary merit and advantages*, which sum he looked for as a *fund to discharge this deficit of his treasurership*. So far from Mr. Jellicoe's defalcations having been revealed to his superiors by his decease, the extent in aid was issued during his life, and an account of his effects, estimated at above £80,000, was made out under it by Mr. Banks, an accountant in the Navy Pay Office. On the day *after* the date of this account, Mr. Jellicoe *died suddenly*, as it is alleged, under distress of mind at the desperate intention of ruining Mr. Cort, who he had thus brought to destruction, by a connection formed upon his reputed high character for "uprightness" and wealth; whereas, he was only an adventurer, appropriating public money, after the fashion of his superiors, to purposes of private emolument. It is distinctly stated by Mr. Trotter, in his evidence before the Commons Committee engaged to collect materials for the prosecution, subsequently turned into an impeachment to gain the safe loop-hole of *parliamentary influence*, that Mr. Jellicoe's debt had been leniently considered, on account of the great prospects of satisfactory repayment from his *iron undertakings*. And there appears no reason whatever that dictated to the worthy treasurer and paymaster a different course in 1789. At the period the extent was issued, the new puddling and rolling works at Cyfarthfa and Penydarran had been in successful operation about six months (as proved by a letter in my possession from a man of honour, Sir Jeremiah Homfray). Mr. Jellicoe's prospects of replacing his balances were, therefore, far more certain and immediate at the moment the extent was issued than at any previous period of official lenity towards him. Whether Mr. Jellicoe had irritated or offended his excellent superiors, by refusing his name to any of their private cheques, we can only conjecture. It appears that at least one other cheque for the treasurer's use was procured from him, viz., for £20,000, subsequent to the £10,000, and he may have been reluctant to go on staking his credit in a doubling rate. But there certainly is no evidence of any particular disfavour to Mr. Jellicoe. On the contrary, the extent in aid was only carried out so far as to ruin "the little mill at Fontley;" as soon as this was broken up proceedings were stayed, and Mr. Samuel Jellicoe put into easy possession of his father's residue. This unusual staying an extent in aid, without realising the imperative object of the affidavit, as the only means to save the public from total loss, was closely inquired into by the Commissioners and Committees which investigated Lord Melville's alleged frauds, and it appears to have been skilfully managed. A *temporary* solicitor, (Mr. White) not the regular solicitor to the board, was employed to *begin* the proceedings, and he excused himself for not completing them, on the ground that not being the regular solicitor, he required further special instructions from Mr. Trotter, which *he never had*. If the proceedings had been duly completed, Mr. Cort's liabilities (if in fact he had any with a man not his partner) would have been cleared, and he would have remained in possession, not of the little mill at Fontley, for that was destroyed, but of his *patents* and dues, amounting to £185,000 at their expiration.

Every reader can now understand why, in 1812, a Committee, packed under the same "parliamentary influence" which managed to obtain a minority, in 1806, upon Lord Melville's guilt, should have reported in the *greatest haste*, contrary to the *evidence before them*, that Mr. Cort's inventions were of *no value*, that there was *neither novelty nor merit in the principle and application of the puddling furnace and grooved roller*. The climax of that "parliamentary influence," which has been too often the bane of representative government, was reached the year after, when the same House of Commons, in full assembly, attacked with cool resolution the rudiments of arithmetic, and voted that 21s. were equal to 28s.

Had Mr. Cort's grievances been, as hitherto supposed, merely a consequence of apathetic neglect or unconscious ignorance, the case was sufficiently serious for any intelligent nation to have to bear, but what are we to say to it as a systematic persecution, destroying life, character, and rights of property, to screen high-born misdeeds. Lord Melville, after the suspicious destruction, by burning, of documents vouching an expenditure of £134,000,000 of public money, retired into private life with pensions from the public purse of £6,000 a-year. The daughters of the man whose ruin he effected, a benefactor to the whole world as well as his own country, could only be afforded £19 per annum each.

I was told about thirty years since, by one of those quaint pretenders to high philosophy, the astrologers, that learning and science were then entering into the *royal sign*. I presume he knew, or thought he knew, what he meant, and we may certainly console ourselves that there is a change, when we reflect on the distinction which, of late years, has been afforded to intellectual utility by the unprecedented efforts of the illustrious president of your Society, and that the occurrence of such dismal events as I have narrated is become impossible. The day is happily passed, when genius can be publicly trampled beneath the heel of selfish political adventurers, and the redress, as far as may be, of evils perpetrated in those darker times, is equally worthy the animated attention of those enlightened minds who will not only protect the living but do justice to the dead.

I am, Sir, your obedient servant,

DAVID MUSHET.

Jan. 29, 1856.

PROPOSED DIGEST OF PARLIAMENTARY PAPERS.

Leeds, Jan. 30, 1856.

SIR,—Among the various valuable suggestions which have been made to the Society of Arts at each conference of delegates from the Institutions, that for securing a distribution of the more important parliamentary reports and other documents to the Institutions, seems in some danger of being forgotten. One cause of the apparent indifference with which this subject is regarded, arises from the practical difficulties which attend it. In the first place, there is no member of the legislature like the late Mr. Tufnell, actively endeavouring to secure this boon from Parliament. Had Mr. Tufnell lived, the probability is, that some plan of achieving this object would before this have been settled. Even, however, if the legislature granted their papers to the Institutions, and intrusted the selection to a Committee of the Society of Arts, as was suggested, the very valuable information contained in those documents, would be lost to the vast majority of those persons to whom it would be most useful. Although a Committee of selection would, certainly, not trouble the Institutions with the custody of documents such as the Hull Bribery Commission inquiry, which nobody ever read, or ever will read, yet there are other parliamentary papers, such as the Sebastopol inquiry, that on the closing of the Public Houses on Sundays, on the Adulterations of Food, and may others, which contain a large amount of most useful and interesting facts most desirable to be preserved, only it is buried under a mass of verbiage and utterly worthless matter of not the slightest interest to anybody. What is wanted, is some compendious document, prepared by competent persons, presenting the important facts and statements in a compact and readily accessible shape.

The recently established union of the Chambers of Commerce, has given birth to a suggestion on the part of Mr. Leone Levi, their London agent, for accomplishing this great desideratum. Mr. Levi is already distinguished by various excellent works on commercial subjects, and no man could be better fitted, both by his knowledge, his previous labours, and his present position of representative of the Chambers of Commerce, to undertake such a task. Mr. Levi proposes to publish "A Digest of the whole business of the Session, with a classified, analysed, and carefully matured review of every social and political question; and present, in a whole view, the mutual bearing of all public documents which now stand isolated and unassisted." The work is proposed to be published in numbers, and in distinct series, distinguishing those relating to finance, commerce, justice, diplomacy, public health, &c., with a view to their being bound together in distinct volumes. It would be issued in bi-monthly and monthly parts during the Parliamentary Session, and at intervals during the recess." Mr. Levi proposes that the whole should be annually comprised in about 1,000 pages of super-royal 8vo., and at a cost of four guineas per year.

The question is, can a sufficient number of subscribers be obtained to warrant Mr. Levi in undertaking this heavy task? There are wanted, at least, 500 subscribers. The members of the House of Commons alone ought to furnish the requisite number. The work ought to be on the shelves of every Mechanics' Institute and every public library. It is one of national importance, and it is the first practical proposal to bring an authentic record of the transactions of the legislature and great departments, in a compendious and available shape before the people.

In my humble opinion, the Society of Arts would render a great public service by taking the work under their especial patronage; let them send a specimen copy of the work to all the Institutes in Union with them, and also to all their members. The Chambers of Commerce ought likewise to take up the subject in the same spirit. It would, indeed, be a pity if so excellent a project fell to the ground for want of support. Sufficient will it be for Mr. Levi to perform the mass of literary labour involved, without running any pecuniary risks in addition.

Trusting my suggestion may meet with your approval,
I remain, Sir, yours respectfully,
JAMES HOLE.
Hon. Sec. of the Yorkshire Union of
Mechanics' Institutes.

INSTITUTION CLASSES AND LECTURES.

SIR,—I regret I was obliged to leave the meeting of Representatives of Institutions in Union, at the Society of Arts, on the 18th inst., at an early period of the discussion, else I should then have taken an opportunity of making the few remarks with which I now beg to trouble you.

As regards the proposed examination of classes, I think there can be no question of the extreme desirability of the course suggested by the Council, and I am glad to perceive the unanimity of feeling in this respect, which pervaded the observations of the gentlemen who spoke on the subject at the meeting, as reported in this week's Journal.

Great difficulties doubtless exist to the establishment of such a general system of examination as is contemplated by the Society of Arts, but the importance of the movement, and the popularity of the measure, will, I trust, be met by the united exertions of those Institutions in Union, whose classes come within the regulations of the Council, to give the scheme a fair and proper trial.

As regards the value of the certificates proposed to be given to successful candidates, I cannot conceive a doubt that such certificates must necessarily, from the care with which they would be distributed, and the high character of the examinations, be regarded as valuable proofs of ability and talent, and employers of labour, whether Government or public companies, or private parties, would surely give due weight to such evidences of qualification for service. The certificates would thus become invaluable passports to employment.

As regards the second subject of discussion, viz., lectures, I am desirous of recording the opinion of my Committee as to their value and importance. At this Institution, which, although numerically small, is comparatively large in its sphere of action and consequent benefits, we have lectures every fortnight during the winter season, and monthly in summer; and in but few instances have we had occasion to remark on the thin attendance of members. We have no doubt of the value of lectures, both as an incentive to the frequent meetings of the members and their friends, and as a means of information and instruction, especially when illustrated by good plans and diagrams, where the nature of the lecture may require them.

We are largely indebted to the Society of Arts for introductions, through the medium of their excellent List of Lecturers, to several gentlemen, whose subjects have given much valuable information, and universal satisfaction to our members, and I take this opportunity of expressing our gratification at the decision of the Council, as announced by Dr. Booth on the 18th inst., to continue this most useful book of reference, although even in the modified form proposed.

Should you consider this letter of any service to the cause, either of class examinations or lectures, I shall feel obliged by your giving it a place in the next Journal.

Yours faithfully,
F. J. MACAULAY,
Hon. Sec. to this Institution, and Chairman of its Managing Committee.

London and South-Western Literary and Scientific Institution,
Brunswick House, Wandsworth Road, Jan. 26, 1856.

CLASSES AND EXAMINATIONS.

SIR,—I see by the Society's Journal that it is intended to promote "the working and formation of classes, with a view to the subsequent examination of the members, such examinations to be followed by certificates as tests of merit in those examined." I think that such a measure (if properly carried into effect, as I have no doubt it will be,) is likely to prove extensively beneficial.

I am, dear Sir, very sincerely,
JOHN RENNIE.

Spring Gardens, 30th January, 1856.

Proceedings of Institutions.

BURY.—The annual meeting and *soirée* of the members of the Athenæum was held on Tuesday evening, the 15th of January, Mr. John Robinson Kay, President, in the chair. The report, which was read by the Secretary, Mr. Pomfret, stated that the number of members registered during each quarter of the last year was as follows: first quarter, 761; second, 683; third, 599; fourth, 674. For the previous year the numbers were, for the first quarter, 746; second, 758; third, 674; fourth, 850; thus showing that there has been a decrease during the last year. Sanguine expectations are, however, entertained respecting its future progression. There have been added to the library by donation and purchase during the year, 72 volumes. The circulation during the year in the various departments has been as follows: history, antiquities, biography, and anecdotes, 1526; geography, voyages, and travels, 649; mathematics, natural philosophy, and natural history, 730; fine arts, useful arts, and social and domestic economy, 383. In mental and moral philosophy, philology, criticism, and political economy, 425; poetry and the drama, translations from the Greek and Latin classics, 335; novels, tales, miscellaneous and collected works, literary and scientific periodicals, 5536. Total during the year, 9586. The weekly average circulation was 191 volumes. The propriety of establishing in connection with the Athenæum a free library, has for the present been abandoned, in consequence of the passing of Mr. Ewart's bill, providing for the establishment of free libraries in other than corporate towns. The number of daily and weekly newspapers with which the Institution is supplied is 87. The classes generally have been tolerably well attended, and the members are making satisfactory proficiency. The average attendance in the various classes is as follows: junior writing and arithmetic, 39; adult writing and arithmetic, 50; female writing and arithmetic, 12; English grammar and composition, 9. The French class now contains seven members. The amateur drawing class is attended by 11 members. The mechanical and architectural drawing class is in a very prosperous condition. The chemical class consists of nine members. The essay and debating class has been re-organised, with a view to the discussion of subjects calculated to be of most service to the members, in giving an impetus to the desire for acquiring a knowledge of history and general literature. The choral society, under the conductorship of Mr. D. W. Banks, has made considerable progress during the year. The concerts and some of the lectures have been well attended. The financial statement showed that the income during the year amounted to £636 8s. 9d., and the expenditure to £640 19s. 9d.—Mr. **Thos. Wrigley** moved the adoption of the report, and in doing so expressed regret that the advantages which the Institution had to offer were not seized with more avidity by the operatives in the town.—The resolution was seconded by Mr. **James Park**, and carried unanimously. A glee having been sung by some of the members of the Athenæum Choral Society, the Rev. **Canon Hornby** moved, and the Rev. W. R. **Thorburn** seconded, a resolution declaratory of the advantages to be derived irom Mechanics' Institutions.—The **Chairman** then announced a number of prizes to be given to young persons connected with the Institution, who had made great proficiency. French language, David White; English grammar, John Bentley; writing class, Richmal Crossley and Alice Warburton; chemical class, Charles Whitehead; arithmetic, Hugh Alexander; writing, Henry Bird; arithmetic, Joshua J. Canon; writing, Richard Thompson. The proceedings closed with the usual votes of thanks, and the election of officers for the ensuing year.

King's Lynn.—The first report of the Committee ot the Stanley Library, for the year 1855, commences by referring to the constitution of the Library, which is briefly as follows:—Lord Stanley makes a donation of £1000; this is met by an equivalent of £50 per annum from the Corporation of the Borough; £600 is paid for the purchase of rooms in a building, which comprises museum, lecture-rooms, class-rooms, &c., of which sum £300 is taken from Lord Stanley's gift, and £300 is obtained upon a charge of the Corporation gift; the remaining £700 is expended in outfit and books. The governing body consists of a committee of 8, of whom 2 are appointed by Lord Stanley, 2 by the Corporation, and 4 by the subscribers. The subscription is 1s. per quarter, commutable to 3s. per year payable in advance. The subscriber is entitled to take home 2 or 3 volumes, as the case may be; seven days per volume are uniformly allowed for reading, the librarian having a discretionary power of renewal; and a fine of 1d. per day is exacted upon volumes overdue. For those who prefer reading at the Institution, a reading-room is provided, lined with excellent maps and well furnished with periodicals; and both library and reading-room are opened daily from 10 a.m. to 10 p.m., Sundays excepted. The Library is in union with the Society of Arts. The Library opened with a stock of 1,700 vols.; the Committee retaining a portion of their capital in hand until experience showed in what direction additions were most required. The Library now numbers 4,106 vols. Donations have been received from the Theological Book Club of 377 vols.; the Ecclesiastical Architectural Society, 50 vols.; the Conversazione, 74 vols.; and the News-room, 97 vols.; while individual subscribers have contributed 562 vols. The remaining 2,496 vols. have been purchased at a cost of £543 7s. 8d., being an average of 3s. 8d. per vol. A department of books expresaly suited for juvenile readers has been added to the Library. A new catalogue has been prepared by the Honorary Librarian (Mr. George Webster,) in which the object has been to furnish, not only a complete index of all the works in the Library, but also of their subjects. There are eleven sub-divisions, and in the arrangement of the Library itself the same classification has been followed. The catalogue will be posted from time to time in MS., but an abridgment only will be published. There are now 782 members, of which number 159 are quarterly subscribers. The average weekly issue has been 1,021 vols.; the greatest, 1,187 vols., and the least 900 vols. The operations of the Library, however, have not been limited to the town. With the express sanction of Lord Stanley, a plan has been announced for establishing rural branch libraries, in connexion with the central Institution at Lynn. Up on payment of an annual subscription of from £1 to £3, a village club is entitled to take out books at the rate of 15 vols. for £1, which are exchanged monthly; thus a subscription of £3 enables a village club to procure the reading of 540 vols. annually, selected by themselves from a collection of more than 4,000 vols. There are already six of such branches in union, numbering about 220 subscribers. The branch issues at present amount to 180 vols. per month.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Chemical, 8.
Entomological, 8.
Tues. Royal Institution, 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Renewed Discussion upon Mr. Robinson's paper, "On the Past and Present Condition of the River Thames."
Linnæan, 8.
Pathological, 8.
Wed. London Inst., 3, Mr. Robert Grant, "On Elementary Astronomy."
Geological, 8, 1, Rev. Professor Haughton, "Researches on the Granites of Ireland;" 2, Captain E. Bedford, "On the raised Beaches in the Western Isles of Scotland;" 3, Mr. M. Moggeridge, "On Sections exhibited at the Excavation of the Swansea Docks;" 4, Mr. Consul Miller, "On the late Volcanic Eruption of Manna Koa, Sandwich Islands."
Pharmaceutical. 8.
Thurs. Royal Institution, 3, Professor Tyndall, "On Light."
Zoological, 3.
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Photographic, 8, Anniversary.
Royal, 8½.
Fri. Astronomical, 8, Anniversary.
Philological, 8.
Royal Institution, 8½, Prof. H. D. Rogers, "On the Geology and Physical Geography of North America."
Sat. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January 25th*, 1856.]

Dated 29th September, 1855.

2170. Henry Bernoulli Barlow, Manchester—Improvements in mules and other machines of the like nature for spinning and doubling cotton, and other fibrous materials. (A communication.)

Dated 15th October, 1855.

2301. John Micklethwaite, Leipzig—Improvement in propelling and steering vessels.

Dated 16th October, 1855.

2309. William Cotton, Loughborough—Improvements in the manufacture of looped fabrics.

Dated 24th October, 1855.

2375. James Smith, Liverpool—Improvements in apparatus for giving alarm signals, and for extinguishing fires.

Dated 23rd November, 1855.

2641. Augustus Dacre Lacy, Hall-house, Knayton, near Thirsk—Machinery or apparatus for agricultural purposes, to be used in combination with stationary steam power.

Dated 24th November, 1855.

2647. John Elce and George Hammond, Manchester—The employment of a new material in the manufacture of wicks for moderator lamps.

Dated 27th November, 1855.

2672. Edward Peyton and Duncan Morrison, Bordesley Works, Birmingham—Improvements in the construction of metallic bedsteads and other articles to sit or recline upon.

Dated 29th November, 1855.

2695. James Egleson Anderson Gwynne, Essex Wharf, Strand—Improvements in instruments for indicating pressure or vacuum.

Dated 3rd December, 1855.

2717. Frederick Walton, Wolverhampton—Improvements in papier-maché trays.

Dated 4th December, 1855.

2725. William Hartcliffe, Salford—Improvements in weighting the top rollers of machinery used in preparing and spinning cotton and other fibrous materials.

Dated 11th December, 1855.

2795. John Horsley, Cheltenham—Certain means of treating quinine and iodine, and other mineral medicines, in order to cause them to combine with cod liver oil, or any other fish oil, or with seed oil.

Dated 15th December, 1855.

2835. Samuel Twist, Birmingham—Improvements in casters for furniture and other purposes.

Dated 22nd December, 1855.

2901. James Newman, Birmingham, and William Whittle, Smethwick—Improvements in the manufacture of hooks and eyes, and in machinery to be employed in the manufacture of the hooks aforesaid.

2903. William Stevenson and William Crawford, Lochwinnoch, Renfrew, N.B.—Improvements in machinery or apparatus for carding or preparing fibrous materials.

2905. Isaac Atkins, New Basford, Mary Gate, Nottingham, and Marmaduke Miller, Wollaton-street, Nottingham—Improvements in apparatus for measuring and regulating the flow of gas.

2907. William Henry Zahn, New York, U.S.—Improvements in wind mills or wind engines.

2909. James Chesterman, Sheffield—Improved spring, especially applicable to the joints of knives, razors, scissors, and other like articles.

Dated 24th December, 1855.

2911. Sylvain Mathurin Gillet-Oudin, Blois—Improvements in making bread.

2913. William Symons, Tavistock—Improvements in the suspension roasting jack.

2915. George Lean and Robert Thomson, Glasgow—Improvements in weaving.

2917. Richard Archibald Brooman, 166, Fleet-street—Improvements in treating beetroot and other saccharine vegetable substances, in order to extract alcohol therefrom, and at the same time render or leave the remaining parts of the vegetable fit food for cattle.

Dated 26th December, 1855.

2919. Alexander Tolhausen, 7, Duke-street, Adelphi—Improvements in double-acting pumps. (A communication.)

2921. Franck Clarke Hills, Chemical Works, Deptford—Improvements in economising fuel.

2923. Thomas Duppa Duppa, Longville, Salop—Improvements in generating and heating steam. (A communication.)

2925. Charles May and Edward Alfred Cowper, Great George-street Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.

Dated 27th December, 1855.

2927. Edward Alfred Cowper, Great George-street, Westminster—Improvements in combing wool and other fibrous substances, and in machinery for that purpose.

2929. Nicholas Douglass, St. George's-in the-Fields—Improvements in the construction of lighthouses, beacons, piers, and other similar erections.

2931. James Edgar Cook, Greenock—Improved composition for preserving exposed surfaces, or surfaces liable to deterioration and decay.

Dated 28th December, 1855.

2933. Jean Jules Robert, 18, Portugal-street, Lincoln's-inn-Fields—The fabrication of torrified beetroot to supersede chicory as used in coffee and with a great superiority.

2937. Paul Marie Salomon, Rue Neuve St. Eustache, Paris—Improvements in the manufacture of gas from peat and in the coke resulting therefrom, and also in the apparatus connected with that manufacture.

2939. William Rowett, Liverpool—Improved mechanical arrangement for lifting weights and other useful purposes.

2941. John Pemberton Turner, Birmingham—Improved method of shanking metallic buttons, applicable to the heading of nails and other like purposes. (A communication.)

Dated 29th December, 1855.

2943. Herbert Redfern, Shelton—Improvements in skates.

2945. John Broadbent and Stanley Peter Youle, Manchester—Improvements in machinery or apparatus for cutting out the gores of umbrellas and parasols, which said improvements are also applicable to cutting out forms or shapes for other purposes.

2947. William Brown, Glasgow—Improvements in cooking and culinary vessels and utensils, and in the application and conveyance of heat.

2949. Silvester Lees and Edward Lees, and George Henry Newton, Oldham—Improvements in machinery for spinning and doubling cotton and other fibrous substances.

2951. William Edward Newton, 66, Chancery-lane—An improved process of tanning. (A communication.)

Dated 31st December, 1855.

2953. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in the treatment of coal, and in the purification, desiccation, and agglomeration of coal, and in machinery and apparatus for such purposes.

2955. James Taylor, Britannia Works, Birkenhead—Improvements in apparatus for raising and lowering weights.

2957. James Cochran Stevenson and John Williamson, South Shields—Improvements in the manufacture of soda and alkali.

Dated 1st January, 1856.

1. Henry Truelove, Liverpool—Improvements in gloves.

3. John Calvert, Strand—Improvements in extracting metals from their ores.

5. William Beckett Johnson, Manchester—Improvements in steam-boilers and engines.

7. John Thurrell, 32, Castle-street, East, Oxford-street, Elizabeth Mary Muller, 58, Greek-street, Soho, and John Robert Chidley, Gresham-street—Improvements in transmitting fac-simile copies of writings and drawings by means of electric currents.

Dated 2nd January, 1856.

9. William Bullough, Blackburn—Improvements in machinery or apparatus for sizing yarns.

11. George Hamilton, Great Tower-street—Improvements in apparatus for weighing.

Dated 3rd January, 1856.

13. Richard Gill, Grove terrace, Pomeroy-street, New Cross—Improvements in the arrangement and construction of the fire flues and passages of steam boilers, for facilitating and improving the combustion of smoke.

15. Charles Toye, Gloucester-street, Queen-square, Bloomsbury—Improvements in terry fabrics.

17. Joseph William Schlesinger, Northfleet—Improvements in the mode of using emery, glass, and sand, or other substances, or linen or other material, and in the machinery applicable to the manufacture thereof.

23. Alan Stewart, 85, Regent-street—Improvements in measuring the human figure, and in fitting garments thereto.

25. Colin Mather, Salford Iron Works, Manchester, and Charles Millward, Salford—Improvement in steam and vacuum guages.

27. John Fowler, jun., Bristol—Improvements in machinery for giving motion to ploughs and other implements used for cultivating land.

Dated 4th January, 1856.

29. Henry Bernoulli Barlow, Manchester—Improvements in machinery for carding cotton and other fibrous substances. (A communication.)

31. Charles Hart, Iron Works, Wantage—Improvements in portable steam engines, and in apparatus connected therewith, for tilling and cultivating land.

33. Robert Gray, 21, Ridley-place, Newcastle-on-Tyne—Improvements in machinery or apparatus for moulding bricks, tiles, and other similar articles.

35. Thomas Key, Bethnal-green—Improved knife-cleaning machine.

37. Joseph Wright, Burton-upon-Trent—Improvements in furnaces and fire-bars.

39. Joseph Betteley, Liverpool—Improvement in the rolling of iron for the making of ships' knees.

41. Robert Sam North, Derby, and Ralph Peacock, New Holland—Improvements in metallic packings for pistons.

43. William Saint Thomas Clarke, 29, Charing-cross—Improvements in ventilation.

Dated 5th January, 1856.

45. Raymond Kammerer, Ostend, and Charles Brewer, Chelsea—Improvements in electric clocks or timekeepers.

47. Henry Hindle, Cavendish-street, Ashton-under-Lyne—Improvements in valves or apparatus for regulating the flow of steam and gas.

49. Louis Auguste Thérése, Paris—Improvements in harness.

Dated 7th January, 1856.

51. Victor Delperdange, 125, Rue Verte, Schaerbeck, Brussels—Improvements in metallic and elastic packing.

53. Samuel Cunliffe Lister and William Tongue, Bradford—Improvements in machinery for combing wool, cotton, and other fibrous materials.

55. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for boring and excavating. (A communication.)
56. Alfred Vincent Newton, 66, Chancery-lane—Improved mode of manufacturing rods, shafts, and tubes of iron and steel. (A communication.)

Dated 8th January, 1856.

58. Matthias Edward Bowra, 63, Basinghall-street—Improvements in the nature and manufacture of waterproof garments and other goods.
61. Edwin Thomas Truman, Old Burlington-street—Improvements in artificial palates and teeth.
63. Peter Armand le Comte de Fontaine-Moreau, 4, South-street, Finsbury—Improvements in jacquard machines. (A communication.)

Dated 9th January, 1856.

65. John Talbot Pitman, 67, Gracechurch-street—Improved mode of applying diastase and heat to the saccharification of starch. (A communication.)
69. William Barrie, Comm. R.N., Maida-hill, London—Improved reflective leveller. (A communication.)
73. Lambert Alexandre, New York—Improvements in propellers for vessels.
75. William Watson, Leeds—Improvements in the arrangement of furnaces.

Dated 10th January, 1856.

77. Martin Billing, and Frederick Augustus Harwood, Birmingham—Improved machinery for the manufacture of paper bags.
78. John Darlington, Albert-street, Newington—Improvements in the manufacture or production of zinc or spelter.
80. Jane Ann Herbert, 5, Waterden-place, Guildford—Improved method for extracting the dirt, or the gum, or the coloring matter, or the principle from various vegetable or animal substances or materials. (A communication.)

Dated 11th January, 1856.

81. James Fernihough, Dukinfield—Improvements in steam boilers and apparatus for consuming smoke.
82. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in cards for jacquard mechanism. (A communication.)
83. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in railway breaks. (A communication.)
84. Thomas Charles Clarkson, 216, High-street, Wapping—A combination of certain materials for forming and making improvements in ship and other pumps, tubes, and which is also applicable for ship carriage and other building purposes and parts thereof.
85. Alfred Vincent Newton, 66, Chancery-lane—Improved method of curing meats, preserving provisions, and ventilating and cooling buildings, cars, and vessels. (A communication.)
86. William Pole, Storey's-gate, and Frederick William Kitson, Leeds—Improvements in railway wheels.
88. William Routledge, Salford—Improvements in cocks or valves for regulating the flow and pressure of steam, water, or other fluids.

Dated 12th January, 1856.

90. Emile Constantin Fritz Sautelet, Paris—Improved process of tanning.
92. Harry Emanuel, Hanover-square—Improvements in the manufacture of spoons, forks, and other similar articles in metal. (A communication.)
94. Richard Kemsley Day, Plaistow—Improvements in the manufacture of fuel.

Dated 14th January, 1856.

96. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in balanced slide valves for steam engines. (A communication.)
98. Adolf Pollak, Vienna—A new fusee or cigar light.
100. Edward Hammond Bentall, Heybridge—Improvement in the construction of machinery for cutting and pulping turnips and other vegetable matters.
102. Austen Chambers, Canterbury, and William Harrison Champion, Lynsted, Kent—Improved mode of working railway breaks.
104. Anne Emilie Malteste, Paris—Improvements in shirts.
106. William Owen, Rotherham—Improvements in stoves and fireplaces.

Dated 15th January, 1856.

108. Joseph Hostage, Thomas Ives Brayne Hostage, and John Tatlock, Chester—Improvements in railway chairs.
110. Thomas Hill Bakewell, Welford-road, Leicester—Improvements in ventilating, warming, and cooling rooms and other places.

Dated 16th January, 1856.

112. Henry McEvoy, Hall Street Works, Birmingham—Improvements in locks, latches, and staples.
114. William Prangley, Salisbury—A novel instrument for exercising the third finger, and thereby facilitating the playing upon musical instruments.
116. John Abraham, Birmingham—Improved machinery for the manufacture of percussion caps, and for cutting out and raising articles in metal generally.
118. Johnson Thompson, Sunderland—Improvements in ships' kelsons.
120. John Fowler, jun., Bristol—Improvements in machinery for ploughing land.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

122. Henry R. Worthington, New York, U.S.—A machine for measuring the flow of liquids, called a "fluid metre."—16th January, 1856.
160. John Wordsworth Robson, Grundy-street, Poplar New Town—Improvements in machinery appertaining to water-closets and pumps.—21st January, 1856.
170. Dundas Smith Porteous, Paisley—A rotary engine.—22nd January, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 25th, 1856.

1692. David Davies.
1695. James Beattie.
1707. Charles Hodges.
1710. William Bridgewater.
1711. Charles Felton Kirkman.
1715. Charles Emile Paris.
1727. Joseph Marie Fillier.
1740. Bashley Britten.
1781. Henri Auguste Pradel.
1801. Edward Cooke.
1817. John Lee Stevens.
1825. James Gardner.
1835. Ebenezer Daggett Draper and George Draper.
1841. Gilbert Sanders and Richard Edward Donovan.
1850. Alfred Vincent Newton.
1856. Joachim Hayward Stocqueler and William James Buchanan Saunders.
1941. William Johnson.
2009. George Collier.
2119. John Page and William Robertson.
2229. William Rogers.
2349. William Field and Edward Jeffreys.
2359. Alexander Parkes.
2371. Jacques Rives.
2427. Henry Edwin Drayson.
2404. Thomas Thomas, jun.
2526. Charles Joseph Hampton.
2535. William Crosley.
2566. Cyprien Marie Tessié du Motay.
2606. Jeanne Barbe Ve Lopez.
2658. Enoch Harrison and Hilton Greaves.
2712. Westley Richards and Joseph Rock Cooper.

Sealed January 29th, 1856.

1735. Nehemiah Brough.
1736. Hall Colby.
1758. Jean Baptiste Mourguet.
1777. John Avery.
1809. Victor Delperdange.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 19th.

144. William Riddle.
212. William Tranter.

January 21st.

167. John Medworth and Lawrence Lee.
177. Charles Randolph and John Elder.

January 22nd.

169. Peter Hubert Desvignes and Francis Xavier Kukla.
272. Joshua Murgatroyd.
316. Richard Prosser.
341. Henry Pooley.

January 24th.

197. Nicolas Francisque Ador.

January 25th.

200. John Henry Johnson.
255. Edmund Leach.

January 26th.

210. Robert Shaw.
216. George Edmond Donisthorpe and John Crofts.
217. James Pole Kingston.
218. Thomas Symes Prideaux.
219. John Scott Russell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3805	January 24.	Improved Tap	Frederick Smith	Birmingham.
3806	January 29.	Rotatory Map Stand	Thomas Poole Alexander Macgillivray	Princes-street, Cavendish-square.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 8, 1856.

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EXAMINATION OF MEMBERS OF CLASSES IN INSTITUTES.

The Council of the Society of Arts propose to hold, at their House in the Adelphi, an Examination of Candidates from the Classes of Mechanics' Institutions, during the week commencing the 9th June next. The subjects of examination will be, Mathematics, Mechanics, Chemistry, Physiology, Botany, Geography, English History, English Composition, and the Latin, French, and German Languages. The following are the names of the examiners:—The Astronomer Royal; Dr. Bernays; Hon. and Rev. S. Best; Rev. Dr. Booth, F.R.S.; Rev. Professor J. S. Brewer; C. Brooke, Esq., F.R.S.; Rev. Professor W. Browne; Dr. Carpenter, F.R.S.; Harry Chester, Esq.; Rev. S. Clark; the Dean of Christ Church, Oxford; Viscount Ebrington, M.P.; Rev. Dr. Elder; J. Glaisher, Esq., F.R.S.; the Dean of Hereford; R. Hunt, Esq., F.R.S.; Dr. Bence Jones, F.R.S.; Professor Moseley, F.R.S.; Rev. Baden Power; F. R. Sandford, Esq.; John Simon, Esq., F.R.S.; Professor Edward Solly, F.R.S.; Rev. F. Temple; Rev. Dr. Vaughan (Harrow); Dr. Watson; Professor John Wilson, F.R.S.E.

Full particulars respecting the examinations will appear in the next number of the *Journal.*

The Council have the pleasure to announce that Robert Stephenson, Esq., M.P., F.R.S., President of the Institution of Civil Engineers, and Vice-President of this Society, has placed at the disposal of the Council the sum of ten guineas, for promoting the proposed Examinations of Members of Classes in Institutes.

The Council are also glad to learn that at a meeting of the Committee of the Lewes Mechanics' Institution, held January 30th, 1856, a report of a meeting of Representatives from various Institutions, held at the Society of Arts, on the 18th of that month, having being received from Mr. Henry Browne—

It was resolved:—

"That the proposed plan for class-examinations for certificates and testimonials is most important, highly beneficial to Mechanics' Institutions, and likely to assist in the self-education of the members; this Committee beg to express their entire approval of the proposition, and hope that it may be effectually carried out."

COMMITTEES OF REFERENCE.

The subjoined list is published in accordance with the following Bye-law:—

36. The Council shall proceed, as soon as convenient after the Annual General Meeting, to form lists of those who may be considered specially eligible to serve with others on such Committees of Reference as may be appointed from time to time. To these Committees the Council may refer for examination, advice and report such discoveries, inventions, improvements, and novelties in Arts, Manufactures, and Commerce, and other matters, as shall from time to time be brought under its notice. The names of the members so selected to serve on the several Committees of Reference shall be published in the *Journal* of the Society, and due notification of the Council's desire to obtain their co-operation and advice shall be given to each member.

ART.

Sir Charles Barry, R.A., F.R.S.	Architecture.
James Bell, M.P.	Architecture.
John Bell	Sculpture.
Henry R. Bradbury	Printing.
R. E. Branston	Wood Engraving.
Vincent Brooks	Lithography.
Decimus Burton, F.R.S.	Architecture.
F. S. Cary	Painting.
A. E. Chalon, R.A.	Painting.
R. D. Chantrell	Architecture.
A. Claudet, F.R.S.	Photography.
Edward Clowes	Printing.
George Clowes	Printing.
John Coe	Printing.
Henry Cole, C.B.	
Dominic Colnaghi	Engraving.
J. G. Crace	Decoration.
Hon. E. C. Curzon	Ancient Art.
P. H. Delamotte	Wood Engraving and Photography.
William Day	Lithography.
C. Wentworth Dilke, B.C.L.	
Roger Fenton	Photography.
A. W. Franks	Ancient Art and Decoration.
P. W. Fry	Photography.
George Gwilt	Architecture.
Edward Hailstone	Ancient Art.
Michael Hanhart	Lithography.
Philip Hardwick, R.A., F.R.S.	Architecture.
B. Waterhouse Hawkins	Modelling.
M. Rohde Hawkins	Architecture.
H. T. Hope	Ancient Art and Decoration.
Owen Jones	Architecture and Decoration.
W. E. Kilburn	Photography.
Rev. W. T. Kingsley, B.D.	Photography.
J. H. Lance	Painting.
G. C. Leighton	Lithography.
John Leighton	
George Mair	Architecture.
Count de Montizon	Photography.
William Mulready, R.A.	Painting.
Matthew Noble	Sculpture.
Rev. J. L. Petit	Architecture.
Richard Redgrave, R.A.	Painting.
David Roberts, R.A.	Painting.
Henry Roberts	Architecture.
Sir W. C. Ross, R.A.	Painting.
William Rowney	Lithography.
Sidney Smirke, A.R.A.	Architecture.
John Thompson	Wood Engraving.
William Tite, M.P., F.R.S.	Architecture.
Henry R. Twining	Painting.
Thomas Uwins, R.A.	Painting.
John Webb	Ancient Art.
Charles Whittingham	Printing.
M. Digby Wyatt	Architecture and Decoration.
Leonard C. Wyon	Medals.

Manufactures.

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S. H. Blackwell.
J. M. Blashfield.
Henry Blundell.
T. W. Booker, M.P.
Thomas Broadwood.
John Brocklehurst, M.P.
Charles Brook.
Robert Brown.
John Bull.
Joseph Burch.
William Caldecott.
R. L. Chance.
William Charley.
Chas. Thornton Coathupe.
George Courtauld.
John Crossley.
Joseph Curling.
Abraham Darby.
Thomas De la Rue.
Thomas Dickins.
Henry Doulton.
Robert T. Fauntleroy.
Henry Forbes.
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John Jobson Smith.
Henry Spicer.
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John Wilkinson.
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Thomas Winkworth.
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William Bird.
Charles Henry Blake.
Edgar A. Bowring.
John Strettell Brickwood.
William Brown, M.P.
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John Dillon.
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Peter Graham.
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Earl Grey.
William Hawes.
Thomson Hankey, M.P.
Thomas F. Henley.
Jonathan Hopkinson.
A. C. Ionides.
Henry Johnson.
Professor Leone Levi.
Matthew Marshall.
George Moffatt, M.P.
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THE WORKING CLASSES OF EUROPE.*

The condition of the European workman is so intimately connected with the progress and development of the Arts, that the following letter, giving an account of the contents of a work recently published by M. Le Play, cannot fail to be read with interest by the members, the more especially as the work, from its size and price, is not likely to be in the hands of many.

SIR,—The man whose energy and surprising activity finally succeeded in bringing out triumphantly the Paris Exhibition, which, in its first stage, threatened to become a failure; the man who again stamped a peculiar character on that grand rendezvous of European industry by throwing open a gallery of cheap articles for the use of the labouring classes, that same man now lays before us the result of twenty years' arduous labour and research in his important work, intituled, "Les Ouvriers Européens," or, the "Workmen of Europe."

Those who are personally acquainted with M. Le Play, at first sight find it difficult to realise how he can have found time for the deep and complicated investigation of such an extensive subject. Himself a celebrated metallurgist, a no less eminent engineer, constantly entrusted by his Government with affairs of a most absorbing nature, one is tempted to ask, How can this writer have commanded data and information sufficient to present us with a most astonishing compendium of both the moral and material condition of the labouring classes throughout all Europe.

And yet so it really stands; for the work now before us already ranks single and supreme, of its kind, in the world of social economy.

The general character of the *Journal* does not allow of a critical review of M. Le Play's work; I shall therefore confine myself to a summary sketch of its contents. Our Mechanics' Institutes might find therein abundant materials for many an interesting lecture, which cannot fail to elicit sympathy from the audience, in proportion to the invaluable information the latter would derive therefrom.

"The two extreme regions of Europe," says M. Le Play, in his Introduction, "offer to the eye of an observer a spectacle of a very different character: whilst the northern and eastern populations continue to live on in a state of general contentedness with their lot, and a sort of quietude, which strike every intelligent traveller; the western populations, on the contrary, under the impulse of necessity, or the stimulus of excitement, are ever agitating for alterations in their habits and institutions. The researches which have given rise to the present work go far to prove the truth of the above statement or fact—a fact predominant, in many respects, over the social problems of our times. The comparative situation of these two populations shows itself more particularly conspicuous in our *Atlas*, wherein no less than thirty-six monographs bring forth the real condition of so many agricultural and industrial artisans. These thirty-six types were studied and investigated in every country throughout Europe, and certainly throw some light on the special character of civilisation in this part of the world; but, above all, they supply the reader with a series of precise results concerning the relative welfare of the various European populations, thus giving us a clue to the singular contrast above alluded to.

"The welfare of a family belonging to the working classes rests, in every grade of civilisation, upon two essential foundations: labour, which procures a livelihood; and foresight, which regulates the disposal thereof. Now, the love of labour is frequently found to be wanting in a rude state of society; and foresight is a still rarer occurrence. Nay, even among such nations as general opinion and incontrovertible symptoms place at the head of civilisation, the above virtues are but imperfectly developed in the multitude, so that these societies could not even maintain their existence, did not both their institutions and manners compensate, in a degree proportioned to the imperfect condition of the improvident classes, for that very insufficiency of individuals. This latter obligation is so truly imperative, and the labouring classes lapse into such a violent situation as soon as it ceases to be fulfilled, that the several measures adopted for its fulfilment, form, indeed, in every country, the most striking feature of the social system. In this respect, Europe, with her numerous sub-divisions, presents three ruling *régimes* which have been successively realised in the history of the most advanced nations, just the same as childhood, youth, and manhood, follow upon each other in every individual existence.

"The *régime* of *forced engagements* or compacts, which prevails among such populations as are labouring under a low state of moral development; a *régime* which requires, in the upper classes and in the government, the smallest display of ability; and which, in fine, viewed merely in a practical light, may be considered as the most simple and most efficacious of the three systems, consists in leaving but a narrow scope to the free will of the working man, and in laying upon the master's shoulders the full responsibility of his welfare. This state of things, which has been illustrated in the present work by several remarkable instances, reigns in one-half of Europe, but especially in Russia, in the Sclavonic provinces of Turkey, and in Central Europe. According to this system, the workman is bound to accomplish the labour, on certain conditions determined by law and custom. But, on the other hand, the employer or patron is equally bound to foresee every eventuality, to provide for all the wants of the artisan and of his family, by bestowing upon the latter a downright legal mortgage upon the produce of his labour." (p. 9.)

It would be a very false idea to suppose, continues the author, that, under this system of compulsory engagements, the population is discontented with its lot. Wherever this social organisation is not vitiated by a laxity in morals, and as long as the employer duly fulfils his obligations, the workmen evince a strong attachment to their condition, and a no less strong aversion to any alteration.

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* *Les Ouvriers Europeens.* Par M. Le Play, Commissaire-General de l'Exposition Universelle. Paris, Capelle, 1855.

The second system or *régime* consists of *voluntary and permanent engagements.* It prevails throughout many countries of the North, the West and South of Europe, where it evidently implies an extensive development of individual liberty. They are invariably founded upon a long succession of tutelary influences over the labouring classes, upon the love of labour, and upon the enjoyment of certain advantages compatible with the welfare of a well-organised family. But within the bosom of no nation whatsoever can certain protective institutions be totally dispensed with; for these seem naturally to pave the way to that complete liberty towards which modern nations are now progressing. Such institutions are numerous in many countries of Europe; in general, they are the offspring of custom and tradition, not of positive law, and appear to form the true foundation or ground-work of European society. With this system, the conditions protective of the welfare and security of the working man are no longer imposed by law; but each family gratefully inherits the traditional order, handed down from generation to generation, conformably to the prevailing tendency of national character and laws, but above all by the benevolent disposition of the proprietor or industrial employer. In the eyes of M. Le Play, this *régime* is the best, the most congenial to the noblest instincts of mankind, the most favourable to that progressive movement so truly characteristic of modern society. We hasten to add that our author bestows upon England the praise of realising better than other nations the ideal of this superior system of voluntary and permanent compacts between the working man and his immediate employer.

The third system of compacts between the employer and the working man is of a transitory nature (*engagements momentanés*). The propagation of democratic principles having produced its natural effect of weakening the influence of the upper classes, the lower ones are under the obligation of providing for themselves. In some European countries, such as Norway, Switzerland, and Spain, the transformation from one *régime* to another has been accomplished without giving rise to a decline in the national character, or even with positive advantages for the people. The principal causes to which this phenomenon is attributable, are a large proportion of parochial lands and commons belonging to the people, and the co-existence of sound municipal institutions. In other countries, on the contrary, such as England, France, Belgium, and the North-west of Germany, the establishments of the temporary system has done away with the old habits of patronage, and completely altered the character of both classes. The most striking feature of the new *régime* may be seen in the sudden agglomeration of artisans and workmen in the neighbourhood of the coal-mines and factories which abound in the above-mentioned regions. In these great marts of industry, the master and the workman soon become total strangers to each other; their only connection is of a transient nature, and they feel utterly free from any mutual obligation. Sometimes even we see the workman abjure the blessings of a sedentary life as well as the most positive conquests of civilisation; he is no more attached to the workshop where he finds employment, to the house he inhabits, or to the place where he was born: nay, more, in some cases, he relapses even into the habits and customs of nations far below the scale of European civilisation. But too often do these nomadic tribes of a new cast fall beneath the latter in point of morality; and the official returns bear evidence that this inferiority is accompanied with circumstances most afflicting for humanity.

Hence the necessity for reforms in the the latter system, many of which indeed have been already attempted. But, unfortunately, none of these attempts have been sanctioned by experience, and they have thus proved abortive: more or less they have every one of them turned out to be the offspring of theories *à priori*, which would not bear the test of facts. The exponents of those social theories generally maintain that the cause of this non-success lies in the selfishness of those who govern society. But here again the impartial observer must needs be struck with the fact that, throughout all Europe, there does not exist one single government systematically disposed to discard any one amelioration called for by public opinion. On the contrary, the positive cause of sterility among statesmen in their initiatory measures of reform is precisely the want of unanimous support on the part of public opinion, pointing out with certainty the road on which Society is to progress. Even in our days, no less than in the past, ignorance and prejudice still carry it with a high hand.

However, it must be admitted that no European society remains inactive in regard to social reform; many partial attempts have been crowned with success, and that very success has been hailed with universal approbation in proportion to its being grounded on the practice of other countries.

But, if such be the case, what is this but a phenomenon similar to what took place in the natural sciences. So long as their adepts laboured in the field of theory they were stationary; but as soon as, under the guidance of Bacon, they applied themselves to the observation of facts and to experimental philosophy, as soon as emerging from preconceived notions, men came to have a definite idea of the weight, measure, and image of an object, they made rapid strides in the scientific world, and, to their great astonishment, were enabled to point out the theoretical laws by which the universe is governed.

Now why not apply the same system to the study of social organisation? Why should we not investigate the leading *facts* by which the labouring classes are distinguished, before we lay down any particular theory? Why, again, when speaking of what a government ought to do concerning industry, and the direction of those same classes, why should we decide, according to certain preconceived notions, upon the all-important questions of wages, state interference, the artizan societies, or upon any other exclusive organisation of the body politic? Evidently, the only method to be followed in this case is to approve any one of two systems which, in analogous conditions of practicability, favours to a higher degree the morality and welfare of a family, as well as the mutual affection between masters and workmen. Thus, for instance, the measure of appreciation applied to that morality and welfare must be certain facts, the importance of which are universally admitted. "Thus we may affirm that a family is in a good condition when its head is moderate in his tastes, just and affectionate towards those who are dependant upon him; when he finds in a regular sort of labour sure means of a livelihood; when, again, his wife, equally faithful to her duties of a spouse and a mother, maintains order and cleanliness at home; when the children show themselves respectful towards their parents; when all, in fine, yield to old age, to the infirm and to the sick that share of respect, affection and care, to which they are entitled. Every new system of organisation which would endanger the security of the family, or tend to weaken the above virtues, must be considered as defective, however it may, in other respects, be conformable to the general tendencies of civilisation."

Such is the scientific basis on which Mons. Le Play establishes his important work:—a direct method of observation applied to the different classes of workmen throughout Europe. The reader may see already that his method bears a strong resemblance to our own system of parliamentary committees and reports, which has had so many fruitful results in our country. Indeed, we shall have more than one opportunity to observe that the author evidently has a bias in favour of the English organization of society. From such a man, a tendency of this kind is no small praise, and ought to make us proud of our constitution, in spite of all its faults and deficiencies.

Here the reader will doubtless inquire by what means M. Le Play was enabled to investigate, through the method of *direct* observation, the condition of the working men throughout all Europe. To this we may reply that his official station as an eminent metallurgist in France, and as a professor at the Government *Ecole des Mines*, has furnished him with means refused to many. His travels on the continent for scientific purposes have been, more or less, continued during the last twenty years, a circumstance which put it in his power to gather a mass of evidence concerning the labouring classes of each nation far beyond the reach of the resources of a man in ordinary circumstances: whilst, on the other hand, he has sifted that evidence with a degree of precision belonging to scientific men alone.

The preceding lines contained what may be termed the preliminaries of M. Le Play's work; afterwards he enters fully upon his subject, and the reader follows him with interest. Fully aware of the importance of precise definitions, he first proceeds to state what he understands by the term *workman*, which, he says, does not convey the same meaning to every mind, and in every language. This brings him to establish the following definition: *A workman is a person accomplishing manual labour of any kind other than that resulting from attendance on the person of the master; and who partakes more or less of the condition of a proprietor or industrial employer, and whose principal means of existence arise from the remuneration granted to his labour.*

This comprehensive definition enables the author to include within the reach of his researches the nomadic tribes of the Oural, or the peasantry of Wallachia and Hungary. no less than the civilised artisan and mechanic of cities like London or Paris. Upon this same definition, he likewise establishes his investigations relative, 1. To the organisation of the family in the four social systems of Europe; 2. To the organisation of communities and corporations; 3. To the systems of patronage adopted in favour of the labouring classes; 4. To the different characters which more particularly distinguish those workmen who have the entire enjoyment of their free will, and the manner in which they spread gradually throughout our part of the world. When speaking of the latter subject, M. Le Play is led to the following conclusion:—

"If we do not suffer ourselves to be led astray by any secondary consideration—if, according to the method laid down in the present work; we sift things to the bottom, we shall soon find that all the sundry varieties of the labouring classes may be definitively reduced to two grand types; the first type (alas! but too rare in our actual state of civilisation), including such workmen as are supported by a feeling of foresight and providence, and constantly tend to acquire property by means of their savings, thus gradually engendering a revenue which increases their resources. The second type, by far more common, consists of individuals obeying an opposite tendency, who consume beforehand the resources they are to receive, live upon credit as long as it is not withheld, and know of no other restraint but necessity. At the very first glance into domestic life, as soon as we begin to draw up the budget of a family, in every detail of its existence, we immediately discover either the one or the other of these exclusive tendencies."

The importance of the above data has induced M. Le Play to enter into the most minute details concerning the workman's budget of receipts and expenses. He devotes a separate chapter to every one of the following heads: 1. The different sorts of property a workman may possess; 2. The three species of subventions or reliefs to which he may be entitled; 3. Considerations upon the labour and salary of every member in a family; 4. Of the various kinds of industrial occupations undertaken by working families, and of the profits resulting therefrom.

The expenses are again divided into four sections, including food, habitation, clothing, expenses relative to moral wants, to recreation and health, expenses relative to the profession, debts, taxes, and insurances of the working man. To enlarge on these highly interesting subjects would occupy too much space; a brief sketch of their contents is all that can be given. Thus, under the title of Food, the author examines closely and scientifically the influence of different sorts of vegetable and animal food over the constitution of the working man. The reader is not only interested, but gains a stock of excellent practical information, after perusing what the author says about corn and its numerous varieties; about milk and eggs; about the different sorts of meat and fish; about the wonderful applications of the vegetable world when used by the labouring classes; and lastly, about the various species of fermented liquors consumed as beverages.

Of a still higher character is the section devoted to the moral wants of the labouring classes. With the keen sight of a man who has long studied them as an eye witness, and with the indulgent heart of a Christian, M. Le Play attaches the greatest importance to the preservation of religious feelings among those who fully enjoy the exercise of their free will. He proclaims it an affair paramount to any other; whilst he hardly ascribes less importance to the question of popular education, and especially appropriated to the wants and feelings of the working man. The following passage, relative to the influence of religion among the labouring classes, will be read with interest:—

"Unfortunately," says our author, "when man is left to his own natural impulses, he is seldom so happily endowed, that a modification in his feelings and habits corresponds with a progress in his social condition. Any individual gifted with energy sufficient to overcome a multitude of obstacles in order to attain the position of a landowner, or a manufacturer, will seldom find within his own breast the moral resources necessary for the practice of those virtues which his newly-acquired station requires. Those social systems which have impressed the deepest stamp upon the history of Europe, and have borne nations to the highest degree of prosperity, are grounded upon two opposite principles, though equally consistent with human nature. The former of these systems endeavours to maintain as far as possible the stability of the body politic, and confides the guardianship of the lower classes to certain families, among whom the feeling of this duty, enforced as it is by custom, is handed down from generation to generation. The latter system, on the contrary, proscribes every kind of hereditary classification; within its precincts, every eminent individual, whatever may be his origin, is allowed to ascend every step of the social hierarchy, and society itself is subjected to a direct pressure of such a nature, that the notion of duties to be fulfilled towards the lower classes, impresses itself upon individuals in proportion as they rise to a higher grade. In the former societies, order is maintained through feelings of honour and duty, through that antique motto of the French aristocracy—NOBLESSE OBLIGE; in the latter, it owes its maintenance to the power of religion. The superiority which Europe seems daily gaining, may be attributed, one would think, to the circumstance that her several social constitutions become less exclusive, and borrow from each of the above principles their most beneficial consequences. The societies which are the most successful in combining progress with the conservation of order, are those where the influence of religion is predominant, where the great social virtues do not cease to form a noble inheritance of certain families, whilst eminent individuals, whatever may be their origin, are not debarred from rising to the very first ranks.

"These observations would require, doubtless, to be more fully developed, were it within our compass to insist upon the moral condition of the upper classes; but they are sufficient to conceive the part which religion has to play, when considered in her relation with the economy of society, in the emancipation of the labouring classes. She favours the development of foresight among the inferior types, by curbing their grosser instincts; she exerts over the eminent types a still more beneficial influence, by animating them with an energy they would seldom find within themselves, and by securing to them those moral resources so highly necessary to prevent the exaggeration of the above virtue. Religious feelings form the natural balance of such habits, as are engendered by a constant straining of the mind towards lucre and economy; they initiate the workman to the new duties implied in the passage over to a higher station. In order to estimate the true value of the progress made by the labouring classes, it is therefore necessary to ascertain whether the development of religious feelings advances apace with the tendency to providence. In this respect, one of the most decisive symptoms is the coexistence of a strong disposition to economy, and of a tendency to relieve by alms and donations such persons as have fallen into a state of destitution. This is the reason why we have devoted a special paragraph to this sort of outlay in the 4th section of our budget."

Hitherto, we have been accustomed to look upon the numerous and motley populations which inhabit the Russian Empire as one great mass of the human species condemned to wretchedness and misery. The narratives of travellers, the data furnished by economists, the information supplied by diplomatists, and last, though not least, the events of the present war, have taught us to consider the forty-eight millions of the Sclavonic race that live under the Czar's sceptre in Europe as little better than barbarians. Our feelings and opinions in this respect are probably of the same nature as those which animated the Athenian or the Roman when speaking of nations not included within the range of their splendid enlightened civilisation.

In some respects, this feeling is perfectly correct, and founded upon positive facts; the writer of the present lines has himself seen enough, during a long residence in Eastern Europe, to bear witness to the accuracy of the above-mentioned statements. But, like all sweeping assertions, it allows of many restrictions; nay, one may even affirm, with no less truth, that the Russian workman generally enjoys as much happiness and welfare as his state of society and civilisation can admit of, or much more than a very large proportion of our Western artizans. Indeed, this assertion is not confined to the Sclavonic races, but may be equally extended to many German populations of Central Europe.

This may be startling, but it is at once the duty as well as the merit of works such as the one before us to lay down facts as they really are, to show truth in its nakedness, and above all, never to cater for popularity by flattering the passions of the day.

Besides, after a close and minute perusal of M. Le Play's work, and more especially of his tabular evidence, the reader rises from the book with the following conclusion, which forces itself, will or nill, upon his mind:—

The labouring classes of Northern and Eastern Europe are efficaciously protected against their own improvidence by the care and solicitude of the upper classes. Whatever may be their misfortunes, they are sure to find help and protection in their lord against the casualties of life, and to transmit their small earnings to the children of their children, even supposing their mite not to be increased by care and industry. On the other hand, self-dignity and individual effort to rise in the scale of society are rare occurrences,—exceptions seldom to be met with. This is precisely what one might have expected in a system wherein serfdom prevails.

In Western and Central Europe, on the contrary, everything is left to individual industry and enterprise. The man endowed with a strong will and eminent faculties of the mind, is almost sure to soar above the level of his fellows, whatever may be the untoward circumstances of his condition when he starts upon the road of life.

Such a system is highly favourable to the development of self-government and dignity; it corresponds with a high standard of civilisation. It thus ranks far superior to the former system—a system that may be likened to the infancy of society. But again, the Western system gives rise to evils of a most serious nature; by its very tendency to individualisation, the labouring classes are generally deprived of that benevolent patronage which doubtless falls in with the designs of a wise Providence. Thousands of human beings accumulate around large factories, or within the walls of immense cities, where but too often misery and loneliness await them at the very first accident which befalls them.

That revolutions should break forth,—that a ruling discontent should be the result of such a state of things,—is by no means surprising. Hence the stringent necessity for the upper classes to assume of their own accord a protective power over the improvident and labouring classes,—a power or system in which freedom and individual energy may be allowed free scope, but wherein the disastrous consequences of extreme destitution and isolation would be effectively neutralised. The field is wide enough to call for the display of talents of the highest order and of every description. Above all, we must have no theorising, no Utopia; facts and experience alone must win the battle on which depends the very existence of our boasted civilisation.

The first tribes to which M. Le Play devoted his attention, were the half nomadic Baschkirs, who inhabit the Asiatic slope of the Oural. The village of Mochmet, where he began his investigations, is not far from Ekaterinenburg, one of the most celebrated regions in the world for its mineral riches. The Mahometan inhabitants of the village are partly employed in the gold-washings, partly in those pastoral occupations to which the surrounding scenery and pasture grounds are so highly favourable. Hence, their innate passion for the nomadic life, and for that state of vacant repose, so highly characteristic of eastern habits and manners.

The Baschkirs, in consequence of the latter passion, seldom rise to the possession of riches; but they find a compensation in the enjoyment of an extensive territory, which is possessed undividedly by the whole tribe; and in the social organisation of the family. A state of indigence, such as that often to be met with in Western Europe, is utterly unknown. At any rate, abundant means of sustenance offer an easy resource to those who may suffer from temporary distress. Their fortune may be valued according to the number of wives, mares, cows, and other cattle belonging to the head of each family. The village of Mochmet includes altogether seventeen houses or families:—now the table drawn up by the author, shows that the richest man of the place had four wives, six mares, four cows, and a tolerably large number of sheep; but then he was a substantial burgher.

One of the most remarkable circumstances of Russian life in general, is the fact that, the different members of a family continue to reside in the paternal dwelling, even after the sons and daughters have entered upon the marriage state. Instead of separating, as in Western Europe, and forming so many individual communities, but too often unknown, if not even hostile to each other, they continue to live under the same roof under the authority of the STAROSI, or ancient, who rules over the whole community, like the patriarchs of old. His authority reigns undisputed within his little circle, and his faculties tend solely to employ every member of the family so as to increase the common weal. In consequence of this custom, the family association frequently acquires a degree of independent fortune of which our artisan families would hardly dream. The same rule prevails among the Baschkirs, whose erratic habits are, however, opposed to a mode of existence essentially grounded upon a sedentary life. At the same time, M. Le Play observes, that the very leisure attendant upon nomadic customs, gives birth among certain highly gifted individuals to meditative powers, to a distinction of manners, and even to an acuteness of intellect which is seldom to be found in the same class throughout our own western world.

In regard to the Russian peasantry, its condition may be generally assimilated to the description which the author gives of a family residing upon an estate in the steppes of Southern Russia. The case would not be, however, the same, when speaking of the peasants inhabiting the western parts of the empire, where their condition is far more degraded and liable to oppression.

"The whole family we are speaking of, says M. Le Play, was brought up in the Græco-Russian form of worship, and punctually fulfilled their religious duties, conformably to tradition, to the impulse of a lively faith, and to the prescriptions of the laws. In this respect, they are precisely upon the same footing as all Russia.

"These dispositions are rather the result of instinctive faith than of any rational development of religious feeling: they do not preserve the members of the family from an inclination to drunkenness, to dissimulation, or even to fraud in money matters; but, on the other hand, they inspire the Russian peasant with a stoic resignation in his moral and physical sufferings; they contribute to maintain a deep feeling of respect towards parents; in fine, when death comes on, they strengthen his soul with a degree of security and serenity which at times attains a character of veritable grandeur.

"Women do not seem to breathe a deep feeling of chastity; however, parental authority, combined with early marriages, contribute to the preservation of good morals. The patriarchal constitution of the family, the great security arising from the protection of the land, no less than the abundant resources as to living which every family has at command, stamp the social intercourse with a certain propriety and dignity seldom to be found in the same class at the other end of Europe. The religious festivals and family anniversaries give rise to frequent meetings between friends and relatives; on such occasions, hospitality is proffered and practised upon even a munificent scale. Many families, by taking advantage of the *abroks*, rise gradually to a large fortune; but their order and economy never degenerate into sordid avarice, nor induce them to forget the obligations of each head of a family towards his children, friends and municipality.

"The relations between the peasantry and their lord are of the best description; they are strongly marked by that feeling of respect and familiarity shown by children to their father. There are no instances of that hostility between conflicting interests which are so frequent in Western Europe. The landowner never denies the peasant his right to a certain quantity of arable land, to pasture ground, to forest wood, and even to the chase. Oppression and violence are always an exception; the lord's authority, far from weighing heavily on the peasant, forms a foundation for the preservation of property, and the maintenance of a patriarchal organisation. This happy state of things arises from excellent traditions, themselves grounded upon a deep sentiment of equality, upon unity of race, and religion."

The *abrok*, which the author alludes to in the above passage, forms one of the most striking features of the Russian body politic. Throughout the whole of the north, the west, and the south regions of the empire, where the soil repays but indifferently the toils of the labourer, and where a population relatively dense successfully turns its activity to manufacturing and mining interests, the landowners usually give up to the peasantry the whole land and employment of their own time, on condition of paying an annual tax called *abrok*, or capitation tax. It is somewhat similar to our system of land rent, from which however it differs in one essential feature. The *abrok* is indeed a collective tax, falling not upon individuals, but upon the parish or commune, the local municipal corporation undertaking to assess its distribution among the heads of families.

The industrial population of Russia, who mostly contribute to supply the manufactures and sundry crafts of towns and cities with the necessary artisans, are almost exclusively subjected to this system of *abrok*. Though bondsmen by birth, and continuing to be so, they enjoy great personal liberty, thus being enabled to choose their own occupations, provided they are punctual in paying to the lord their trifling share of this yearly rent. Neither a prolonged absence, nor a large amount of profit, prevents the itinerant workman from returning to his family; on the contrary, the authority of his father, combined with the obligations due to his lord, and a sort of instinctive fear of abandonment and isolation, all tend to bring him back to the small community to which he belongs.

The industrial artisans who are employed by the lord himself in the mining districts, form a distinct class, described minutely by M. Le Play in his 4th and 5th tables. Though, in some respects, these mechanics bear a strong resemblance to those of our own part of Europe, still they differ from them in the fact that, in case of misfortune, they are ever sure to find support and relief in the landowner, who considers this a part of his most serious obligations.

In the rich and fertile provinces of the south and the east, where hands are wanting for the labours of the field, the landowner merely portions out a part of his estate to the peasantry for themselves to live upon, whilst he cultivates the rest and turns it to account for his own purposes. In return for this grant of land, as well as for the house and garden he inhabits, which are rent-free, the peasant is obliged to till his lord's land and fulfil the usual employments of an agricultural labourer at least three times a week. This numerous class of peasantry may be assimilated to the *natives* or villeins of the middle ages.

It would take too long to follow the author into all the interesting details furnished by his tabular evidence, wherein every item of account is made to bear in order to show what really is the moral and physical condition of the Russian workman. We must now hasten to other countries.

The North of Sweden is celebrated for iron mines and factories, which are reported the best in the known world. Among these, the Dannemora mines stand prominent, contributing in a large proportion to supply England with that ore of superior quality which enables her steel cutlery to compete successfully in every market of the globe. The ore of iron is treated with charcoal in about ten factories, situated in the immediate neighbourhood of the mine. As the winter season is the most favourable, like in Russia, for carriage and land communication, the products of the furnaces are transported on sledges to the small ports of the coast, from whence they are sent in the spring by sea to Stockholm.

The labouring population consists mainly of tenants, of small landowners, and artisans bound to the mines, factories, and furnaces, by temporary engagements, but which are in reality continued from generation to generation between the parties. Here every man enjoys his own free will, and yet all are so bound to the patron that the character of the tenure may be considered as voluntary and permanent at one and the same time. To every factory is annexed a considerable extent of arable land, on which the proprietor has a certain number of tenants. These pay the rent of their farms by supplying so many days' labour throughout the year for hewing wood, for the converting it into charcoal, and conveyance to the furnace, and, lastly, for the cultivation of the patron's land. The principal element of prosperity in this social organisation, common to all Sweden, lies in the intimate connexion existing between the employer and the workman. The latter is insured against all casualties, by the kind and enlightened interference of the former. It is certainly no feeble argument in favour of the Swedish system, that from these semi-agricultural semi-artisan tenants are chosen the *peasant*-deputies, who are so truly remarkable for their patriotism and sound good sense in the national parliament.

"The condition of the Swedish workman," observes M. Le Play, "is a most interesting subject of investigation, as it offers a sort of transition between the compulsory system of Russia, and the voluntary system of engagements adopted throughout Western Europe."

"All artisans and labourers in Sweden enjoy the free command of their own persons; it is an acknowledged principle that they are utterly independent of the proprietors and industrial employers for whom they labour. In reality, however, they are always bound to the latter by traditions and by a complicated system of public or private institutions. Hence arises between the different classes a union which is equally satisfactory to every interest; which secures to the master both the respect and affection of the workmen, by ensuring no less to the latter a benevolent patronage in case of disease, old age, insufficiency of labour, scarcity, or other public evils. That security of subsistence, which is the very first claim of a labouring population, and which is guaranteed in the Russian system only by sacrificing individual freedom, is in this country the natural result of habit, and the national manners. Favoured by this salutary impulse the Swedish workmen have attained a most remarkable degree of morality. No less favoured by the large quantity of land at their disposal, and by the institutions of their country, they often obtain, through their labour and economy, the means of purchasing property. Thus is constantly recruited among the employers and the artizans, that fourth order of landed proprietors belonging to the peasantry, whose influence is daily increasing. The Swedish peasant, having once reached the first rank of landed interest, frequently forms unions, similar to those known in the middle ages, for the prosecution of such enterprises as elsewhere tend to become the exclusive monopoly of large capitalists and rich companies.

"The Swedish women, belonging to the labouring classes, are, in some respects, superior even to the men; they are generally distinguished by a certain graceful demeanour, by a graceful attire, by the care they take of their head-dress and hands; in fine, by the moral qualities and esteem which they enjoy. This superiority of the female sex is the consequence of a time-working tradition in regard to virtue, and of excellent social habits. In many provinces of Sweden, the workmen show their wives and daughters the same attention, the same kindness, which elsewhere are the peculiar inheritance of the upper classes. Females are usually freed from degrading occupations, or such as are incompatible with their sex. In Sweden, it is a rare occurrence to meet a woman carrying on her back a heavy burden, as is frequently the case in France and Germany. Rarely, likewise, does a woman leave her domestic circle, at least in those branches of industry which are most essential to the development of the national resources. The moral and physical condition of women is far different in Stockholm, and more especially in the cotton mills lately established in central Sweden, under the influence of companies ruled by the financial combinations and technical processes of British industry. The investigation of these new-born centres of production is a good opportunity of showing the perils attendant upon the new economic *regime* which now prevails in the most important states of Europe,—a *regime* which England herself has found necessary to modify by the introduction of energetic reforms.

From the above quotations the reader might be disposed to believe that M. Le Play prefers the social organisation of Northern and Eastern Europe, to our western civilisation. Such a conclusion would be erroneous; his object is merely to show the urgent necessity for our feudal and manufacturing lords to undertake, in favour of the labouring classes, a system of patronage somewhat similar to that held out by our ancestors in times of old. The better to elucidate his purpose, he has devoted two of his monographs to the moral dissection of the Geneva watchmakers. After showing how that class of artisans formerly enjoyed many privileges and resources equally favourable to their bodily and mental condition, he contrasts that condition with their present state, which is a life of improvidence and penury. And yet, adds he, there is hardly any population which equals the Genevans in regard to morality, economy, and self-dignity. They frequently undergo the most painful sacrifices, in order to secure to their offspring the blessings of a sound moral education. Thus, their misery can by no means be ascribed to their vices or degradation. He then concludes with the following observations:—

"The facts stated in the two preceding monographs (18th and 19th), when contrasted with those included in our ten first, will supply the elements of a comparison between the highly different civilisations of the East and West.

"It is more especially by the depth of religious feeling, and by the moral consequences accruing therefrom, that the Genevan artisan, as well as many other types belonging to the West, are decidedly superior to the best workmen of the East, however well disposed they may be to fulfil the ordinances of Islam, or of the Christian religion.

"The favourite amusements of the Genevan artisan reveal, perhaps better than anything else, the preeminence of his moral qualifications. In summer, his great delight is to stroll, in company of his wife and children, through the picturesque scenery which surrounds his native city. The behaviour of each family is constantly marked by a feeling of propriety in all places of public resort; it even forms a striking contrast with what may be observed, on similar occasions, in other countries. In winter, a good workman usually passes his hours of leisure in some society of which he has become a member, and, when he can, attends public lectures liberally given by persons devoted to the progress of the labouring classes. Family readings are likewise considered as an essential source of domestic amusement, particularly by women and the youth of both sexes. Almost every household can boast of a small library; besides, it is an easy matter to hire books at a very trifling expense. This habit of reading, though not always commendable in regard to the works selected, proves, at least, that the Genevan mechanic is not ruled by sensual appetites, or by those propensities which, in the greater part of Europe, place the artisan far below the middle and aristocratical classes of society.

"Meetings of friends and relatives, an exchange of presents on certain family anniversaries, and which usually consist of articles of dress and furniture, form also a striking feature in the habits of the labouring classes at Geneva. The Genevan artisan ever tends to imitate the manners and habits of the *bourgeoisie* placed immediately above him. The details upon which we have entered bring forth the moral advantages of such a tendency; however, the workman frequently goes beyond the limits prescribed by reason and foresight. The evil consequences of this deficiency are illustrated in the youthful couple we have spoken of in the eighteenth monograph. No doubt that improvidence under this form, though grounded upon estimable qualities, may lead to results no less fatal than vice or intemperance; but still these inconveniences, arising out of civil equality, are more than compensated by the moral advantages we have alluded to.

"All observers who will methodically investigate the condition of the labouring classes in Europe, must ever acknowledge the superiority enjoyed both in the north and the east, in regard to material security and welfare. These abundant means of subsisting are indeed the leading trait of Oriental civilisation. By comparing the ten first monographs of the present atlas with the lamentable descriptions published of late concerning the artisans employed in the manufactories of Western Europe, we are forcibly led to ask, whether the wonders of human industry, purchased at the price of such acute suffering, do not in reality mark the commencement of a decline."

After anxiously putting the question under various forms, the author addresses the following reasons for answering it in the negative:—

"The qualities observable among the labouring classes of Russia and other eastern or northern countries, generally originate in a certain number of external conditions independent of individual free-will. If, for instance, a good workman is not addicted to drunkenness, it is because his lord places at his command such ample means of subsistance that hardly any room is left for the display of brutal appetites. Again, if the same artisan labours with assiduity, it is because a severe discipline, founded upon routine, upon local regulations, and even upon the law, protects him against the temptation of idleness. The Genevan workman, on the contrary, is bound by no fetters; his virtue, of a less passive character, does not exclusively depend upon external circumstances:—it is within himself, within the sanctuary of his own reason, that he finds energy sufficient to restrain his passions and fulfil his duties.

"So that by studying the condition of the Genevan artisan, we are brought to the conclusion, that the impluse given to western civilisation is really a progress for humanity. Other instances which occur both in France and England, will serve to refute many a paradoxical position relative to the deplorable condition of the labouring classes. The rapid strides of industry, as well as the development of individual liberty, by no means bring along with them the necessary degradation of the human species. Every religious society that knows how to regulate the movements by which western nations are hurried along, will be able to effect much good without the alloy of those evils too frequently marked at present as its fatal concomitants."

The reader has now before him a number of examples sufficient to show what method the author follows in the investigation of his subject, as well as the highly interesting results to which that method forcibly brings the observer.

The limits of my letter will not allow me to continue the quotations; though Spain, Italy, France, and England, would supply ample interesting materials. I must, therefore, hasten to the appendix, in which M. Le Play produces his conclusions. These are of such high importance, and so peculiarly fitted to the usual habit of mind among British readers, that no apology is needed for giving them rather fully at the close of this letter.

Of late, the law of succession, which, in France and other countries ruled by the civil law, enables a parent to divide his property in equal shares, has become the subject of numerous comments and strictures. Among the French, statesmen, and even lawyers, begin to open their eyes to the pernicious consequences gradually wrought by an indefinite division of land. It is no rare occurrence among our neighbours to meet with people who bitterly complain of a system, which constantly engenders a whole army of needy place-hunters, whilst it places at the mercy of a young spendthrift the treasures that have required long years of labour and industry to provide for future generations.

It is certainly no insignificant circumstance, that a man, so truly guarded in his opinions and language as M. Le Play, should enlist on the side of our English system of entail. But so it really is; to arrive at such a conclusion he must doubtless have overcome many a prepossession in his own mind, but above all the traditions and notions he was taught to hold sacred in his childhood.

After drawing a faithful picture of both systems, the author is led to the following observations, which ought to sink deep into every thinking mind.—

"Both of the above systems were fully represented in the old French constitution; but our revolutionary assemblies, forcibly struck with the abuses arising from the system of entail and mortmain, and no less impressed with notions concerning equality and natural rights, were apprehensive that, by upholding the right of bequeathing property, parents might obtain too great an influence over youths, and thus endanger the new social system. This naturally led them to consider any powerful organisation of the family as a bar to real progress. Besides, upon referring to the debates which preceded the laws of 1790, 1791, and 1792, as well as to the deliberations to which the *code civil* gave rise, it is easy to show that this new law of inheritance, or, in other words, the very ground-work of actual society, was enacted under the impulse of the moment, and without any previous inquiries, such as are looked upon in England as essential preliminaries to the most trifling reform in her institutions. Thus it was that our lawgivers, yielding to an exclusive bias which is condemned by the very principle of European civilisation, abruptly ignored the national tradition. Thus did they all but completely abrogate that right of bequeathing previously enjoyed by our southern provinces, as well as the sundry modes for transmitting property in its entirety, established in favour of the nobility, and appropriated to the other classes by the municipal law of Northern France. But the new law proclaims a sort of fatalism in the opposite direction; it scarcely upholds the slightest vestige of paternal authority, by establishing an endless division of patrimonial property in a way no less exclusive than the old common law of Europe which favoured inequality and indivision.

"The practical rules laid down in this work for the due appreciation of the social movement, here give rise to doubts of a most serious nature: by these we are led to inquire whether France, as far as the social condition of the family is concerned, stands in the true road to civilisation. The law as to succession is the foundation of society, one main cause of its rise or fall: it must therefore become a matter of anxious scrutiny to ascertain the motives on which is grounded in France the maintenance of the present system, as also those tending to a modification of that same law."

After summing up in a most impartial and philosophical manner both sides of the question, M. Le Play is evidently of opinion that the prevailing system is fraught with consequences far more pernicious than could possibly arise from the contrary *régime*. But instead of impelling his countrymen to alter immediately their law in this respect, he merely winds up with the following modest, but judicious suggestion:—

"We propose an inquest upon our law of succession, an inquest which would be to France no less beneficial than was to England the inquest relative to labour in manufactures. It would bring about amongst us a salutary reaction, somewhat analogous to that which twenty years ago triumphed over the most inveterate opinions concerning social economy, and preserved England from an impending cause of disorganisation.

"The opportuneness of such an inquest may be likewise deduced from another order of observations. In the opinion of their own authors, the laws enacted in 1792 and 1803, were destined simply to obviate transitory difficulties. Besides, the illustrious author of the *code civil* soon acknowledged the necessity of balancing the fatal effects of the above laws, by certain institutions, which the cry for equality contributed afterwards to abrogate, so that in order to continue the traditions both of the revolution and of the empire, it would be advisable to ascertain whether those difficulties have not already passed away; whether property, now ultimately incapable of perpetual entail, ought not also to be freed from the pressure of forced division. Upon viewing the subject in this light, it is no difficult task to shew that the determinate motives of our law-givers have not lost their weight. Nobody will fear, for instance, that parents would use their long-lost influence to prejudice their children against all sorts of innovation; nay, it would perhaps be far nearer truth to affirm that such fears have now given way to prepossessions of an opposite nature. Thus, were it once proved that private manners, no less than social tendencies, have undergone due alteration, perhaps it would be high time to retrace back our steps, after fifty years of severe trials, to that progressive road which was necessarily closed, in consequence of the moral dissolution that stigmatised the eighteenth century. The law giver who shall be enabled to resume our old national tradition in this respect, without wounding our modern feelings, nor giving way to a retrograde spirit, that man will really establish upon the continent a new order of things, which so many noble-minded hearts hailed long ago in the grand reforms of 1789."

C. F. AUDLEY.

SOME REMARKS ON MR. J. K. BLACKWELL'S EXPOSITION OF THE IRON MANUFACTURE AT HOME AND ABROAD.

By David Mushet.

I regretted on Wednesday, the 9th of Jan., that time would not permit a prolonged discussion on this important paper, but your valuable *Journal* was referred to as a channel open to supply the deficiency; I beg, therefore, to forward a few remarks. I wish, indeed, so excellent a means was more used for discussing subjects which could hardly be adequately canvassed before midnight, especially when a paper is of such length as to require two evenings for its perusal. I quite admit that the jocose treatment of the matter by Mr. Bird and Mr. Kennard gave an exact picture of the *morale* of the iron trade in this country, but then the very question raised by the paper is, What are likely to be the ultimate consequences to our manufacture of the continuance of this sordid spirit? That the existing tone of society is in all things to do just what will suit the market, and no better, however bad the requirement, is, I agree, an undeniable fact. Books, for instance, are made on the same principle as iron, to meet a standard of quantity, not quality. "Fit audience find though few," would be just as unsuitable a motto at a bookseller's as at an ironworks; money has to be made, and, therefore, the *majority* must read and buy; novels and other popular works may be worse trash than the worst bad iron; even the muse of history has lately been descending to play extraordinary pranks to the call of the same trading requirements; therefore, much more as the uses of iron are practical, and very directly and easily tested, I do not see much harm is done by the making iron just as good as is wanted and no better, provided that this money-making rule of action leads ultimately to no worse consequences. The great question before the meeting was, whether this admitted state of things was tending to our permanent injury, and whether those nations who were alleged to be prosecuting the manufacture in a less regardless and more improving spirit, were likely to steal away by degrees our preeminence. Now I must confess that, laborious and intricate as were the details of Mr. Blackwell's communication, he hardly took that comprehensive grasp of the *comparison* in its main particulars, as to enable us to arrive at a definite judgment whether or not it will always continue in our power "to eat up our rivals off the face of the earth." We cannot form a correct opinion whither the present is leading us, without referring to the steps by which that present has been reached. We cannot pronounce upon the probable future, except by a distinct reference to the actual past. Our position of to day is but one item in a long account, which, taken as an isolated point apart from the rest, means nothing. The most microscopic examination of it will afford no light to the judgment. Even as to the present facts of foreign manufacture, the details were extremely meagre, in the absence of which, elaborate disquisitions on processes perfectly familiar at home, again baulked us of the materials of comparison. I wish we had seen a few large maps of the foreign mineral districts; they would have been a short-hand way of conveying far more effective information of the general facts, and with great economy of time, compared to an intricate verbal delineation. A map of France, for instance, as our greatest European rival, about three yards square, behind the chairman, tracing the edges of the several coalfields, and the main lines of rail which are to bring the produce into cheap competition, would have furnished solid, unevanescent data for our consideration, especially if accompanied with figures of the great alleged depth of these deposits as approximately as has been ascertained. Above all sections of those basins which were hinted at as containing veins of coal of enormous thickness; something tangible, if ever so little, to place in our minds as to their proportion, for instance, with the ten-yard coal of Staffordshire, or the forty-yard anthracite of Pennsylvania. Some facts and figures of the process of *mazeage*, which was recommended as our model, would have been a great addition to the practical value of the paper. Similar exact data of the results of puddling with the waste gases, which has for so many years been urged on us,—one of the foreign accomplishments which we despise,—would have supplied a great desideratum. I should like to have heard an account to date of the progress made by the foreign workmen in the *physical* act of puddling. An English puddler used to be able to turn out as much iron as two or three native foreign puddlers, and it is clear, so long as this disparity continues, it will secure to us the power of supplying cheaper iron at nominally much higher wages. In short, I was led to expect a full *exposé* of *recent* foreign progress, replete with new matter, but heard nothing but what was many years old. For instance, the machinery at Eschweiller, with which Mr. Blackwell seems to have made his acquaintance at the Paris Exhibition, was elaborately reported on in England in 1848, by one of our most eminent engineers. The use of muriate of soda in the puddling furnace, named as practised at Seraing, was patented by my late father *thirty-two years since*, at the time he was engaged in completing the erection of those Belgian works; the addition to it of oxide of manganese was patented by Mr. J. M. Heath, one of the numerous victims to the profound astuteness, the astounding refinements, the exquisite diversity of opinion, and the brilliant wit exhibited by some of our judges when a patentee in this country is asking for his own.

To arrive, then, at any sound opinion respecting the permanent character of our pre-eminence in the iron manufacture, it is absolutely essential to consider how we have advanced into the position. It is quite true, as admitted by Messrs. Bird, Kennard, and Davis, that our iron makers are acting on the principle of making as much money as they can, and, with that sole object in view, some of them have made a great deal, but this does not touch the question, How long shall we be able to do so at all risks with success.

The first grand cause of our position in the iron manufacture, is the extraordinarily copious diffusion, over so large a surface of our limited island area, of the coal and ironstone in felicitous juxta-position. This is the foundation of *what we have done*, and therefore, to know the foundation of what France (for instance) *may eventually do*, it was most essential that we should have had precise data as to that *thickness* which Mr. Blackwell considers will compensate its mineral deficiency in length and breadth. Our second great natural advantage is the proportionate extent of our insular sea-board, and the consequent proximity to it of our principal fields. Those more remote, though triflingly so, compared to the inland French districts, had, early in the last century, been prepared for the market by the system of inland navigation which Brindley instituted. Of this advantage Mr. Blackwell seems to think that foreign railway communication will deprive us; it may indeed tend to equalise past disparity, but it never can annihilate distance. Our third national advantage is the *quality* of our labour. How we are to explain the origin of this difference, may be a hard matter, unless we ask the astrologers, but certain it is that that sullen solidity which has distinguished the battle-fields of our present random shot, hap-hazard war, has had no small share in conquering, with better generalship, our mineral fields, and vanquishing the weighty legions of their produce in the strife of peace, at home. Last—but not least—must be enumerated the solid, self-relying energy of masters as well as men, an independent individual wealth and physical force of mind, fostered by that form of government which this native character has equally created. With these four natural advantages concentrated within our island area, superior mineral wealth, great facilities of transport, strong sinews of labour, backed by strong practical heads, with strong purses all ready for action, Watt's condensing engine rose into existence. This great invention immediately supplied the double blast-blowing apparatus. The one thing needful to furnish the breath of energetic life to our smelting furnaces continuously, with a power independent of seasons and situations, it imparted an immense impetus to the pig-iron manufacture. But one more gift alone was wanting to give vent to all our pent-up energies of nature and of art, and to launch us forth as the unlimited manufacturers of iron for the whole globe. This was a means of converting the plentiful pit-coal pig-iron, by the same cheap fuel, into a serviceable wrought iron, which might compete with the costly metal we drew from forest-covered countries, slowly creeping over the threshold of peopled civilisation. Here again arose, when he was wanted, another of those great practical inventors for vast and solid purposes, which have pre-eminently distinguished our own country—the right man at the right time. From the first development of the manufacture of pit-coal cast iron, our practical ironmakers had seen that it was the greatest desideratum to discover some means by which this cheap fuel could be used for a corresponding development of the wrought-iron branch of the manufacture. Numerous were the attempts, after 1750, to make bar-iron beneficially with pit-coal, but all had proved failures, when, in 1783 and 1784, Henry Cort perfected and patented *two distinct inventions*. Each of them separately had such amazing value, that either alone would have been sufficient to stamp him as the greatest of benefactors to his country and to the whole world. But he doubled this merit, and as grammarians tell us that two negatives in the English language make a positive, we may conclude that, under some similar rule in the English grammar of invention, two positives make a negative, entitling to a reward *minus* and not *plus*, for he was deemed worthy of no recompense but to be shamefully plundered in this life by the treasurer, the paymaster, and the deputy-paymaster of the British navy, which he had signally served, and after his death to have his reputation stolen, and his children robbed by a legislative committee, bound in secret conclave to cloak and keep, if possible in oblivion, at any cost, those official "high crimes and misdemeanours" which had barely escaped their due and imminent punishment six years before. These three great practical inventions, the steam engine, the puddling furnace, and the grooved roller, marching hand in hand, had, by the year 1790, not only rendered us independent of Russia and Sweden for the anchors to our fleets, but had reversed our import to an export trade in iron, when the last link of good fortune was added to that extraordinary chain of natural advantages and native gifts which had combined to the formation of our iron manufacture. The great continental war broke out, and whilst its continued devastations swept the arts of peace from any abiding place over the face of Europe, our country enjoyed, for nearly thirty years, her self-created monopoly of the steam engine, puddling furnace, and grooved roller, to manipulate the produce of her mineral fields, with all her native force of men and capital.

Our iron trade, founded on these great inventions, was planted and firmly rooted before the war began; during the contest it developed itself without a rival; and cheap bar iron streaming from the roller, developed that unrivalled host of manufacturing machines which fed our commerce, and, in union with their parent, the cheap iron trade, provided the sinews of the war. Those old enough can well remember the floods of foreign inquirers and engineers who poured into this country, after the peace, to visit our ironworks, to investigate the causes of that astonishing position in which Henry Cort had placed us, and to transplant our processes. We can likewise recollect the *wise* penalties levied on the exportation of machinery. The steam-engine, the puddling furnace, and the grooved roller have, nevertheless, in spite of them, been now established over both the old and the new worlds; and the question agitated is, are other nations applying them more successfully to *their* mineral resources than we have done to ours, so as to compensate for that greatest of obstacles to competition, an extended inland communication? The excellent system of foreign railways, we are told, will mend this drag, to our disadvantage; it is true they manage these things with a centralising energy of which we know nothing, for all our efforts are individual and antagonistic; but will they ever make 100 miles in one territory equal to 50 in another? Is it likely we shall be beaten by our own weapons, and have the plumes struck from our iron crest by an arrow from our own quiver? We originated not only the railway, but the *means of making rails;* for it is by the grooved roller only that foreigners or ourselves do, or can, profitably produce them. This was the offspring of our native practical acumen, and can we doubt that, whatever demand may arise, we shall again find shoulders equal to the burden. It is by thus considering the subject in its great outlines, and taking the broad facts of difference between ourselves and others, that we can alone attain materials for a comparison. A microscopic examination of a few drops of water taken from two rivers, can afford no light upon the direction of the streams they are taken from, their comparative volume, sources, tributaries, and navigable length, not even if the drops from one should be a little brighter than the drops from the other. Foreigners have a subtle and studious tact, very capable of refining and improving on the substantive material of the inventions they adopt; and it is, therefore, the more to be regretted that this paper furnishes no definite details for judging what they may have lately done in that way in the iron manufacture. But let it be ever so much, it will not do to forget that we *created the original staple*. We can do justice to others without doing injustice to ourselves. Consider the force, the facility, and the comprehensiveness, of the three great practical solid inventions which I have shown are the basis of the iron trade; the plain master grasp with which nature has been seized, and her simple principles forced to conquer her own most weighty difficulties, when the proper moment arrived for attacking in earnest our great mineral treasures, and I think few will doubt the continuance of our superiority if we continue honest. Should other great solid practical inventions be demanded by emergent occasion, is it likely we shall be unequal to the demand? Our fertile and forcible native soil, which has furnished such a crop of them, will be ready again for the sturdy birth; though not highly comminuted for the growth of flowers, whenever the dragon's tooth of necessity is cast into it, inventions, fully armed, will spring up of which now no one dreams.

In the foregoing enumeration of the broad facts of our position and our advantages, the *quality* of our labour is a very important item, against which, so long as it continues, there can be no effectual competing. Labour is the main element in the cost of iron; a man who, in a large establishment, can do double work, is worth four times the wages, so that wages nominally high may be actually low. Foreigners may be most assiduous in ingenious contrivances for lightening physical duty, but, when the utmost is done, there will remain a necessity in heavy manufactures for solid enduring physical capacity, which, when satisfied, will turn the balance. Of the comparative quality of American labour I have no knowledge; but if it equals ours, its higher price, in conjunction with the inland distance of their main mineral deposits, is likely to deprive us, for a long time, of serious rivalry in that quarter. The only great eventual danger is the exhaustion of our stores, and the increased price of materials, as that term approaches. We have gone furthest in that direction; the first and the fastest *in* the race, we may easily be the first *out of it*. But we cannot eat our cake and have our cake. Those, therefore, who are dreading the advance of foreign competition, should rather rejoice at the increase of foreign make, were it many times greater, as a means of promoting the permanence of our home manufacture, that we may go on softly, and not be sucked rapidly to death in assisting foreign nations to reserve their supply until ours is gone. This may be styled the telescopic, in contradistinction to the microscopic, view of the matter.

I have noticed the deficiency in Mr. Blackwell's paper of any precise description of any of those foreign processes, *mazéage*, &c., which he thinks we might successfully copy, and the advantages which would have accrued from giving some comparative character to a description *pur et simple* of our own boiling and puddling operations. I would, therefore, make some little reference to a modification of these processes, actually in use in this country, and not indicated, though it realises the means of obtaining, *if the market called for it*, the very object of the paper, a superior quality of iron at a cheap rate. Its history is illustrative of the difficulty of instituting supererogatory works of improvement, and doing better than is ruled to be necessary by the market demand, even though at no greater cost. The process is one of a long series of experiments for avoiding waste and improving the economy and quality of the iron manufacture, to which my late father perseveringly devoted all the spare time of an active life, and I shall presently refer to another of his means for supplying these desiderata. Rather more than twenty years since, he patented the puddling of pig iron with the pure oxide of hæmatitic and other rich ores. The iron parting with its carbon to unite with the oxygen of the ore, perfectly reduced grey pig iron can be puddled with as much facility, and as little waste, as finer's metal, and the yield is increased by the metallization of the contents of the ore. This method, I conceive, suggested the boiling process, which has the particular economy of working up the waste slags of the forge, instead of resorting to the purchase of new ore. But, as these slags contain all the fusible impurities previously ejected from the metal, this modification produces an inferior iron to the other. Wheh my father's patent was brought into use, it was found that if carelessly worked, without sufficient attention to the small size of the hæmatite, a tendency to red short was developed, the general characteristic of rich ores. My father, having always, I presume, before his eyes a just terror of the rewards bestowed in this country upon inventors who *risk* anything for the public good, made no outlay in carrying on the process, but left it to the adoption of those who might be disposed to the trouble of teaching these men to use it rightly, and keeping them up to the requirements for avoiding red short, and it was but partially introduced. The Staffordshire puddlers well appreciated the increased yield, and gave their masters some trouble in keeping the red ore out of their way. At length Mr. Anthony Hill, of Plymouth works, who has been distinguished for half a century by that *con amore* spirit of improvement in which Mr. Blackwell considers the foreign manufacturers so much exceed us, took up the matter in earnest, and, by taking that intelligent pains which no one else cared to take, introducing proper fluxes, and slightly altering the shape of the furnaces, he brought his operations to the highest economical and qualitative perfection. When I was last at his bar works, the whole puddling furnaces were working on red ore and *cold blast* pig to the greatest advantage. Yet, with the results before them plainly realised, and needing nothing but adoption, his neighbours did not care to encounter the trouble of working workmen into new refinements for making, cheaply, iron of a better quality than the market insisted on. Indeed, as I have referred to the quality of British labour, it may be worth while to notice another characteristic, which is, no doubt, one development of its solid sullen energy, alike displayed under the fire of the field or of the furnace. "The most lazy diligent people under the sun," as old De Foe termed us, we exhibit an equal immoveability either in the camp or the workshop to the exercise of small dexterities and niceties. The British workman makes massive and effective efforts; he grumbles at his objects and overcomes them well. Those lighter qualities, which captivate so many of our travellers abroad, and send them home doleful and despairing over English infirmity, to see a degradation approaching only to be re-animated by an assiduous import and imitation of everything foreign, without a thought whether it suit our habits or possibilities, impart the peculiar characteristic to foreign manufacture. There the workman throws something of the feeling of the *artiste* even into hard labour; he toils *con amore*, and *likes* certain delicacies, which our rough race set their foot on with disdain. This opposes a peculiar difficulty to introducing the *beau ideal* of *quality* into our ironworks out of pure enthusiasm. We can only, as a general rule, adopt such novelty as is certain to be worth the inevitable *rise of wages* on the heels of *rising value*. The Englishman always looks strongly to the *main chance*; "strike" is a very English word; those experienced in the different *manageability* of different nations, will give their testimony that it is less easy to idealise our iron manufacture *in situ* than in the Adelphi.

But Mr. Anderson raised a very important question. As a consequence of the above peculiarities, the natural character of our practical men is averse to a parade of science—to anything like fuss and fiddle-faddle; men who have a great deal of real business to get through, and must get through it by efforts of strong judgment and wholesale decision, have also little time for a wholesale organisation of accessories such as Mr. Anderson described. We may, perhaps, go too far in this aversion, and leave many valuable details unattended to. I admit that the great ironmasters who have mountains of ironmaking materials at command, to pour forth unlimited quantities of gold-making iron, participate to the full in that occupation, the same "lazy diligence," characteristic of the workman in his employment. They are doing what they want to do on a great scale, loaded with weighty concerns and sturdy workmen, and are generally disposed to look on scientific men and their appliances as a sort of small deer they cannot be troubled with. This is no imputation; our first men in the trade frankly admit the prepossession. It partly arises in the *physique* of their minds, naturally enjoying the same rude health as the native workmen's energies, strong in massive purposes,—and partly in the very character of their works, which are not those omnigatherums so correctly described by Mr. Bird, doing a little of everything under the sun. But I fear there is yet another reason in this country for the comparative repulse of scientific aid from the precincts of our great manufactures, namely, the *quality* of that science. The science of the most practical country in the world is, perhaps, the least practical of any. I should hardly venture on this unpopular assertion, though my conviction of its truth is long and deep-rooted, had not the Chairman of Council [Dr. Booth], in the luminous address which opened the present session, advanced these very opinions, and apologised for their "unfashionable" character. There is a sort of metamorphic form of science in this country very peculiar to ourselves—*i.e.*, *science for amusement*. It was in some such spirit that we were told, in 1851, by one of the eight great theologians, that in the most instructive and entertaining lounge of the Great Exhibition was at length discovered that royal road to learning which Ptolemy in vain inquired for. I conceive that nowhere else but in this country is there any considerable number of persons who are able to derive their subsistence by lecturing or talking at large upon essentially practical questions to indiscriminate auditories, who experience no other use in the discourse than to go away and talk of them again. This system, resulting in a general diffusion, or rather confusion, of terms and vague views, something in fact less than smattering, has a doubly deteriorating tendency; it impairs the mind, not of the listener only, but of the lecturer, imparting a superficial *ad captandum* character, rather than a practical efficiency, to the understandings of professors. Doubtless, these conditions find their cause in the efflorescence of native advantages. The superfluity of individual wealth, the great amount of isolated independence, the every-man-for-himself character of our polity, are national features. Our intellects are more solid than frolicsome; and the omnipresent idea of utility which pervades the general public leads individuals to persuade themselves that they become of great use by paying to hear a talk about things useful; and a commercial people being always on the watch to turn everything to account, science, or what is called so, is, *inter alia*, seized upon, and converted into a staple of public trade quite peculiar to ourselves. There is a different management abroad, arising in a different set of causes. The superior wealth and energy is concentrated in their governments; individuals are comparatively nothing. There the great market for talent of the highest order is in the service of the state, and, in consequence, all instruction is systematised for definite ends of state. This is well-known, its effects are seen, and ever and anon some one or other of our own independent energizers, in science, politics, or whatever it may be, sets about to gain distinction on his own hook, by importing some plan to re-model our institutions, in shallow oversight of the fundamental causes of difference. Do we not remember how one of these distinction-seeking coteries, our indigenous growth, each laying claim to the absorption within itself of all light and truth, illuminated themselves and tormented others with the grand discovery of a system of education in Prussia, a measure quite as much of police as of instruction; we were to be regenerated at once by its forcible importations, pains, penalties, and all save military discipline. Not a whit less absurd would it have been to enact, under penalties, that Englishmen should speak German, or have a negro's skin. Great facts cannot be altered by incrusting them with narrow-minded imitations. It is not that our government is weaker than the people, but our people that are stronger than the government. The first scientific men in foreign countries being absorbed in purposes of the state, the same definite centralising impulse pervades their manufactures. *Teaching* anything is there always preparatory to *doing* something, not vague and aimless merely to *diffuse* "general knowledge," as it is termed, a general quite as incompetent and incapable as any who have been grumbled at in the Crimea. Their schools really are schools, and if the fact of the same practical system being found by Mr. Anderson in the American democracy, appears a contradiction; it is not so, because they have no superfluity of rich idle people to listen to idealizing lectures. They must have a practical object for their time. It is therefore to this "science for amusement" that I think we must attribute a great part of that separation of science and practice so much complained of in our country. The professor gains his emolument by what he calls general ideas; when brought to contact with practical action, being unprepared, he is at fault; he makes some upside down application of his general knowledge, which at once disgusts the practical man, and *science* is condemned. Some men troubled with ambition, and a great sense of their own talents, think they have learned everything when they have heard a lecture, and, setting up as lecturers or practitioners on their own account, increase the gap, and, like inspired prophets, rebuke the practical man who will not hear their schemes, and intrust their interests to burlesque speculations. Such vague untested teaching and learning is undoubtedly a great misfortune, though it may be very difficult to find a cure. The popularity, and therefore the profit of these disquisitions is always proportioned to the comprehensiveness of the subject, the discursiveness of the treatment, and its remoteness from practical application. Yet nothing can be learned without deeds as well as words. Whoever made money by general lectures on the four rules of arithmetic, or on the copy-book? We stick to the practical, and give a boy a slate and a pen, not a pair of ears, of any dimensions. What hurts the mind more in any of its divisions than to theorize and not to do? Another of our great commercial pursuits comes in to fan the mischief of science for amusement—viz., the bookselling trade. If a lecturing author has some little fancy, fluent style, and literary tact, so as to make a nice assortment of notions, travels and quotations interspersed with anecdote, twined about a small nucleus of fact, such a composition may become a standard work of science for the drawing-room table, having as much resemblance to philosophy as an historical novel resembles history. Some of our sciences are by this process so thoroughly popularized, that truth is disagreeable, and common sense put down upon the authority of mere literary dreamers. From the peculiar social conditions already referred to, this kind of visionary talent which working men will have nothing to do with, too often finds its way to government patronage, and aggravates the barriers to a true union of science and practice. A man of sound ability in this country can do much more for himself than the government can do for him, hence the public takes the useful men—the state, the pedants and plausible men. This inevitable consequence of our social features, has its misfortunes; it has rendered our government efforts at scientific progress such remarkable failures; they merely provide for that calibre which finds no good market in the general intelligence and wants of a practical nature, and do infinite harm by disseminating, under a certain warrant, theories which are sometimes actually false, and always delusive when not correctly enforced upon the understanding by practice. People are beginning to see that trade in teaching ought to be as much a free trade as any other, and that no good arises by encouraging the weak under bounties upon forced production. Theory and speculation are natural efforts of the human mind, but let them flourish indigenously, not under the seal of authority and at the cost of truth. The talking and reading mania, *de omnibus rebus et quibusdam aliis* has by no means improved our universities. It is better, as has been well said, to know everything of a little, than a little of everything. A mind so instructed knows the greatest of all knowledge, its own ignorance. What can be learned, for instance, by listening to lectures in a collegiate town, upon some unsettled, uncertain arena of speculation, such as geology or political economy. Time and intellect are dissipated in getting up, or rather down, to the general level of talk at random, where nothing is begun and nothing ended. It would prove as practically useful to teach mining and farming in London from a collection of stones and some pots of Dickens's gloomy geraniums. The sciolism of such intellectual dissipation is telling every year more and more in the skirmishing shallow ideas of public men. None would rejoice more than myself to witness such a union of science and practice prevailing in this country as Mr. Anderson describes, and flourishing under our transcendental philosophy of money-making. But this state of things cannot be *forced*, it must spring out of our necessities; it will be only hindered by a further supply of public pedantry. The movement, with us, must come from individuals, and all its requirements will be met when there is real necessity and real danger of receding for want of them. I do not deny there is a large field lying waste and uncultivated, but there seems to be a beginning. The Cwm Celyn Company, for instance, have attached an acute and qualified chemist to their establishment, and I believe they do not regret it.[*] I only wish heartily that our scientific men had more such opportunities afforded them of completing their mental edifices by the coping stone of practice, without which the substructure is labored in vain. They can no otherwise acquire that apprehensive grasp of *main points*, bearing the test of utility, which is so eminently required to save the subdividing scientific intellect from being bewildered in the microscopic detail of closet researches. It is in this more constant opportunity for the union of thought and action that the foreigners have advantage over us. But light is breaking on many sides, and the necessity of a practical finish to a theoretical education becoming acknowledged. Even the great dream is growing troubled, and people are waking to discover what wiser herds long since told them, that restraining the children of the poor all their most docile years from the proper industry in *common things* of daily life, and keeping them amused with eccentricities, which, however interesting, have no bearing on their station or their daily bread, creates only worthless and wretched members of society. *Reforming* them has begun, and may perhaps lead us back to the more rational feature of *prevention*. I trust Mr. Layard's clear views, in his address to the University of Glasgow, may prove *contagious*. With due respect to both houses of legislature, I have not seen so much common sense on this subject from any of their members for many years. Except Cobbett and Colonel Sibthorp, no one has been bold enough to even venture in that direction, and they unfortunately were always laughed at.

I feel at a loss to understand what bearing upon the comparative question it is intended we should give to the lengthy description of the ideal of a blast furnace, because the form described is one of those comprehensive efficacious changes *made by a British practical man* which are eminently our characteristic, thus adding another item to the comparative inference in our favour, and according to the latest sections of foreign blast furnaces which I have seen, this vast improvement has not yet been much adopted by our neighbours. Here again a good large section on the wall would have been a great saving of time, conveying at a glance, for observation and reflection, the fact which has to be travelled after through pages of a delineation in words. By the contrast with a few sections of the furnaces of our foreign rivals, we should have had light at once condensed from twilight. I perceive through the whole of his paper Mr. Blackwell is rather careful to exclude the mention of authorities. He may have obtained the whole extent of geographical and geological details in the various countries by personal unassisted labour, and the protracted reasonings on the blast furnace may be likewise entirely his own, but I doubt if the importance of a man's own labours is at all diminished by reference to confirmatory though no doubt inferior authorities. I like better Mr. Scrivenor's treatment of these subjects; it is more luminous and satisfactory to ordinary minds. The change in the shape of the blast furnace, for instance, is interestingly and candidly referred to its proper author in the last edition of Mr. Scrivenor's most valuable work. The alteration from the old narrow high hearth, the flat bosh, and contracted conical upper chamber, is an event so illustrative in all its particulars, that I confess in listening to an abstract idealized version of the result I felt (to compare great things with small) as if there were before me a history of the change of government in France from a wild democracy to the most illustrious despotism on record, in which the name of Napoleon was entirely omitted, and abstracting time, place, and circumstance, general rules were excogitated to reason us into the knowledge of what a good despotism ought or ought not to be. A matter so important to our iron manufacture as the change of the blast furnace, should never be named without the name of its author, Mr. John Gibbons. Different minds take different views, but I am myself never at ease in any explanation unless I give the merit where it is due, dreading any appearance of the appropriation of what is not my own. Nor, as I before remarked, do I think this exercise of candour diminishes anything from a writer's all-sufficient appearance. It can be no derogation to follow the example of the record which informs all time that "Tubal Cain was the instructor of all artificers in brass and iron." I admit it needed a powerful intellectual effort to give this abstraction of a blast furnace, but it has the disadvantage of abstracting also some of the chief practical principles which guided the investor in his discovery, and making prominent some minute considerations which appear to have more weight on Mr. Blackwell's convictions than they have on mine. But as these have no reference to the comparative trade of different countries, it would be out of place to state my differences, and I will refer to only one of them. I think if Mr. Blackwell will study for three minutes the action of a common sandglass while his egg is boiling, he will not remain of opinion that the materials in the blast furnace descend in the symmetrical idealism of parallel straight lines. I should like to have heard whether any explanation has yet been arrived at of the cause of the extra wear of the sides of the blast furnace above the glazed zone which occurs under the use of heated air, and whether this feature is equally developed in the foreign hot air furnaces.

The mention of Mr. John Gibbons's name, as the author of a comprehensive revolutionising improvement in the efficacy of the blast furnace, would have been the more properly interesting, because his brother, Mr. Benjamin Gibbons, by taking the like grasp of simple principles of nature, which it is the singular deficiency of the inferior mind, simple as they are, always to overlook, has been the great reformer of colliery ventilation in Staffordshire. His improvements established for fifty years in his own works, have more or less perfectly been adopted throughout the country, and but for the vested interests of costly collieries, commenced upon imperfect plans, and which have found in the Davy lamp the great "protection" of their indigenous deficiencies, the loss of life from explosions in all other counties, would ere this, have reached a minimum, which has not been reached, and never will, by the aid of government inspectors. This foreign importation of power without powers is like all our similar attempts, a dead letter. It is beneficial to the inspectors, but, in the absence of all proper force, unbeneficial to the safety of the collier. We ought first to make the crown the universal lessor, as abroad, and this, I think, we are not likely to do; and then, how are we to compass the other desideratum I have referred to, of bringing, according to the foreign fashion, the *first* men into state harness. The mines which the crown does possess in this country are looked after no how. Strings of red tape, proceeding from the metropolis to the country, are poor sinews of management twitched and cut at all turns by *parliamentary* interest. The best officers on the spot are rendered helpless by such a system. At this very moment this mythic power is doing its best to let a large sum of public money slip into private hands, with the addition of inflicting on other private men not so favoured a penalty of some £80,000, with the grossest injustice. If this grievance is redressed, (and by the bye the Ebbw Vale Company have to bear the heaviest share of the burden), it will be owing not to the proper efforts of public officers whose duty it is, but to the public spirit of private men, whose duty it is not, who guard their private interests at a great disadvantage. In fact, the habitual treatment of valuable inventions (the *original* Minié rifle ball, for instance) shows the total incompetency of our official mind.

As Mr. Blackwell has gone so far into the chemistry of the blast furnace as to state the now generally re-

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[*] See, in point, Mr. Scrivenor's letter in the *Journal* of 25th January.

cognised fact, that deoxidation and decarbonisation are effected by the gaseous oxide of carbon, and not by the solid fuel, as was held for many years even after the discovery of a gas so different in its properties to carbonic acid, I think that in a paper read to a general society, some reference ought to have been made to the writers, home and foreign, who first promulgated a theory which has such a new and important bearing on all the processes of the iron manufacture.

It will be interesting to Mr. Blackwell to be informed that the improvement he has suggested, for permitting the employment of the best qualities of perfectly reduced pig iron, without undue waste, in manufacturing bar iron by re-melting the grey pig in a cupola furnace with pure ores of iron, has long since been perfectly carried out in this country. This process formed one of very numerous endeavours of my late father's indefatigable and philosophical mind to improve at once both the quality and the economy of our iron manufacture. He patented the process about the year 1817, and carried it into successful and profitable operation both in Wales and in Staffordshire. But there are always great obstacles to superseding old established operations by anything new, unless there be a commanding commercial necessity to *compel* the change. The old refinery which this process was intended to supersede, was in extensive use; it did well enough for the requirements of the market, and the advantages of the novelty were not of the overwhelming character which can alone induce the trade to encounter the dilemma of re-instructing their workmen.

Such examples are very instructive. They exhibit the difficulties which practical men of the largest capacity, energetic activity, experience, and copious information, have contended with in attempting that improvement recommended in this paper, and how much easier it is for those whose vein of humour lies in that direction to deprecate British stupidity and laud foreign intelligence than to establish the fact.

It would have been important to have had some particulars given of the cases where the wasteful expenditure of pig iron now amounts to 30 cwt. for a ton of puddled bars, so as to judge whether, as implied, this is actually "a sign of the times," or the mere error of insufficient or incompetent ironmakers. The impression conveyed is, that the whole iron trade is retrograding from the former waste of 25 *to* 27 cwt. per ton of bars to 30 cwt., a fact, if true, so important as to demand no slight or ambiguous handling, but a searching investigation into causes and remedies. Such an extra waste amounts upon our yearly make to half-a-million tons of iron per annum destroyed. Mr. Anderson says that forty years since we made better iron, and certain it is that nearly seventy years since, in the very infancy of the puddling process, we had no worse yield. In 1789 the puddling furnaces and rollers erected under Mr. Cort's patents at Pennydarran, were brought into operation; and I have an extract from the books of that firm, dated March 11th, in the writing of Sir Jeremiah Homfray, who was shortly after supplanted in the management of the works by his brother Samuel, who deceived (?) the House of Commons in 1812, giving the result of the first experiments:—

"Feb. 21st, 1789.

"Pigs delivered—Patent furnace, 3 tons 13 cwt. 3 qrs. 7 lbs. Produced: blooms, 2 tons, 8 cwt. 1 qr. 29 lbs.; bars, 2 tons 1 cwt. 1 qr. 20 lbs.

"Takes 1 ton 10 cwt. 1 qr. 23 lbs. pigs to make 20 cwt.: blooms, 1 ton 15 cwt. 2 qrs. 17 lbs. pigs to 20 cwt. bars.

"Chaffery takes 1 ton 3 cwt. 1 qr. 19 lbs. blooms to make 20 cwt. bars.

"Coals used in the furnace, 6 tons 12 cwt."

This was the first trial at the new furnaces. Sir Jeremiah states that the masterman was nearly incapacitated by an accident to his hand, and expresses a certain confidence, when the men are practised, and in proper trim, that 30 cwt. of pigs will be ample for a ton of bars. Further details of progress were cut off by the accession (under circumstances notorious in the county), of a manager determined to defraud Mr. Cort. But as the result is from puddling raw pig, before its preparation in the old refinery was thought of, and as the bars were *hammered*, the rolls not being at that date completed, it is a startling assertion, as a picture of the present position of the iron manufacture, that 30 cwt., after 70 years' experience, is becoming the mark for a ton of bars, refinery, iron bottoms, squeezers, boiling, &c., &c., inclusive. The loss in the chaffery is enough to show that the mere manual skill was in quite an elementary condition.

The *direction* in which we are likely to successfully seek for any abbreviatory improvements in the ironmaking details, is the great question suggested, on which I would offer some hints derived from a long intimate acquaintance with an extent of experiment directed to that very end, of which Mr. Blackwell, I think, has not had the means of forming any conception. The field of success is much more likely to be found in, or in connection with, the puddling furnace, than in any of the processes preceding it. My father's own views, after prolonged experiment, were in favour of that conclusion. Whether the reverberatory furnace is ever to become the sole agent of manufacture for working bar iron, metallized by the direct process of cementation, without fusion, is for the future to prove, and it is not likely to be proved, until the easily reduced earthy ores approach exhaustion. Cast iron is an essential in commerce to an almost equal degree with bar iron; and so long as the blast furnace exists for its production, a part of that produce will continue to be applied to the preparation of bar iron, the blast furnaces thus standing as a barrier to the comprehensive introduction of any system independent of it. But it is not likely that anything of the nature of a second blast furnace will be adopted for treating the pig iron before it reaches the puddling furnace. In so weighty a manufacture, all details of any thing like amateur complication must be as much as possible removed. When the markets of the world and the conditions of supply demand some change in the processes of production, this demand (if ever it arises) is most likely to be satisfied by modifications of the puddling furnace; probably by combining the use of pig iron with the use of rich ores, either raw or cemented, or both, and proper fluxes. Much has been done in this direction, and more may be done when required. The right invention at the right time is but another variety of the "right man in the right place." Circumstances, much more than intrinsic philosophy or ingenuity, command the success of inventors, and nothing more distinguishes the great capacity than inventing, not exquisite refinements, but the great fact which is in instant demand. Watt stept into a wide field waiting for cultivation, and Cort did the same. Steam engines and rollers, in one shape or other, had long been known, but the period had not arrived for their full development. Watt's improvements furnished the means for perfecting the locomotive which now sweeps along thousands of miles of rails stretched out by the agency, essential to their existence, of the grooved roller. It is vain to waste time and labour on inventions not suited to the age; it is for the great and enlightened mind to perceive and work at what the time requires, or is about to require. Existing processes are great facts; to remove them, or to materially modify them, under romantic aspirations after excellence, though such sentiments are the salt of social existence, and their cultivation most laudable, is a very weighty matter. Even when the most animating advantages exist in a novelty, when it is ready to fulfil every urgently desired condition of public service, qualitative, commercial, and economical, its adoption is almost hopeless, should the market be already copiously supplied with a certain degree of an inferior and even dearer article.

Vested interests, plant, skill of workmen, every particular which would be depreciated by a more perfect manufacture, combine to prevent the public from being better supplied. From these combined causes there are inventions languishing at this moment out of public use, which are capable of adding more than another 40 millions to the yearly savings which Mr. R. Stephenson has lately told us are due to railway transit.

And it may be well here to remark on the call made during the evening, and subsequently upon inventors, to devote themselves to furnishing great improvements,—men whom Mr. Bridges Adams, in his letter, rightly designates as the manufacturers' greatest friends. Nothing can be more truly unfortunate than the position in this country of such manufacturers' friends. What with the equivocations of our Patent Laws, and the desperate struggle commonly made by the money-making men to make these gold-producing improvements their own at no figure, or at the lowest figure to the authors, their position as the pioneers of progress is a national stigma. Here indeed is a ready and practical field for qualitative amendment, which I wish Mr. Blackwell had indicated; for, in fact, all his other proposals must remain inefficient while neutralised by this vast grievance. A comprehensive better spirit would carry with it, like a flood, all the accessary details. Friends, if they are, this class of men is treated by the money-makers as their greatest foes. I would readily concede to Mr. Bird and his party that it matters little how much the ironmaster devotes himself to servile gold-finding, rather than to attaining iron of a quality which will find no market, providing the thirst for wealth did not impair the moral quality, and lead him to treat men merely as if they were materials. How far intense and mere commercial habits tend to relax the morality of nations, we may learn from older authorities than Montesquieu. Watt was not beatified as a martyr and a victim, neither was Neilson, but the best attempts were made to confer that fate "more honoured in the breach than in the observance." So certain is it that an inventor in this country will be forced to sacrifice his peace, his interests, and his life upon the public altar of Hermes, that one almost might suppose that those he benefits were mindful of a Druidical origin, and accordingly cemented the foundation of any great edifice of public prosperity with the blood of a human victim. Here, indeed, there is scope for improvement; we truly might do something by levelling this bad eminence which distinguishes us from foreign nations. Anything like the disastrous catalogue which this country can furnish of the treatment of her brightest and most useful children, cannot be matched, or at all approximated, under any foreign government. To devise and carry out in our commonwealth any noble improvements, is pretty sure to be as clear an act of self-immolation as the plunge of Quintus Curtius. He, on that occasion, was no doubt the right man in the right place, but if it be the right place for the inventor, it is but too poor an encouragement for many to aspire after, and beyond doubt deprives the state of many efforts of improvement. The most sound and experienced men do not choose that honour, and exert their energies in exploits of less danger. It is not only the improvement of our patent laws, making them what they ought to be, simply a safe protection for the property of thought which is required, but the establishment of a better spirit amongst the money-grinders, before the call to find them more means to make more money will be responded to as it might be. The treatment of Cort, now attracting so much attention, is only an instance. Certainly it is the greatest in the magnitude of its commercial features, and I only wish it were the worst in its moral and legal details. I doubt if we shall attain to that point of Sir David Brewster's late admirable remarks, which proposes a bounty for inventors, but we surely might *prctect* them, and feel a real *disposition* to protect them, and be thankful for their gifts, securing to them what is their own, instead of levying a penalty upon a man because he happens to have more valuable thoughts than his neighbour. If a fund is to be established for the encouragement of useful inventions, and to aid in protecting them, the foundation would be best laid by some swollen capitalist who has aggregated his two or three millions at the cost of the life and rights of some public benefactor, setting apart the ill-got gains, if not in life, (for the priests of these sacrificial rites have a strong sense of *meum* which seems doubled by absence of the sense of *tuum*) at least after death (which they cannot avoid) to endow a protective and examinative institution which might help a man to his rights, without entering the field of legal quibbles, where the plainest rights are often ridiculously sacrificed to the turn of an empty expression. A discrimination of duties so maintained would tend above all things to preserve the dignity of the judicial functions in respect, for very often, out of mere ignorance, our judges in patent cases so confound the distinctions of right and wrong as to earn the reputation of being the most reckless or hard-hearted of men. They may sit in conscious integrity over the ruin they have made, but the inventing public are equally conscious of a terror of them, and therefore only the very sanguine and eager, and as a consequence the least qualified, are rash enough to venture to devote themselves to this kind of public service. In truth, upon mere commercial principle, I do not understand how those who think iron, steel, tin-plates, &c., &c., are worth notice, and accordingly deal in them, should have no place in their price current for those who show the way to more extensive dealings. These are the very men one would expect to set a value upon an improver as an excellent article. To those who rejoice in an Arcadian or pre-Arcadian simplicity of manners I could conceive an inventor to be an inimical being. The man who toasts, *par preference*, his cake on a forked stick torn out of the thicket, in default of a cutting instrument, who sucks his own goats, or has only a pumpkin rind to milk them into, and in the absence of saucepans or oven ranges, stews or bakes his dinner in a hole in the ground, filled with hot stones, might well repel the intrusion of vendors of hardware, and hang them up on the next tree, but I am at a loss how these latter come to treat what Mr. Bridges Adams thinks are their best friends as their bitterest enemies. In these days of busy exhibition and exposition, when every one is sounding the glories, and making the most they can by hook or by crook, of the toils of inventive merit, it is more difficult to account for torpid neglect or active antipathy towards those who furnish the *Othellos* with all their occupation.

It seems rather a misapprehension to state that the term "boiling" is used in contradistinction to puddling. Some cinder is introduced into the puddling furnace, and the pig iron parting with its carbon causes an ebullition in the fused slag, after which the iron is puddled as usual. Boiling is a variation of puddling of such fractional amount that it can in no way be contradistinguished from it.

I agree that, generally, a great cause of the impression that hot-blast gives an inferior quality of iron to cold-blast, arises in the greater reductive powers of the former, which enables the ironmaster to take liberties with his furnace, impracticable under the old regimen; but there are more definite and useful rules than this for the guidance of public judgment. It is a general feature (of course not without exceptions) that the more fusible an iron the weaker is its body, and as its fusibility is also generally in the ratio of the temperature of smelting, we have a direct reason why hot-blast irons, all other things alike, should be weaker than cold-blast irons. The first great step of increase in the temperature of the blast furnace was the transition from smelting with charcoal to smelting with pit-coal coke, and the result was a pig iron so much more fusible than had previously been obtained, that cast iron assumed a new feature in the arts of this country. See in confirmation, Scrivenor, page

16, quoting the *novelty* of pit-coal iron for cannon, "so soft as to bear turning like wrought iron." Experienced founders are well acquainted with the more refractory character of charcoal pig-iron. The next great step of increase in the temperature of the blast furnace was the transition to hot blast, under which the Scotch iron, always fusible, has become much more so with an attendant weakness of body. There are distinctive differences in the quality and properties of hot blast and cold-blast iron, which ought not to be lost sight of or confounded, quite irrespective of that degree of imperfect reduction which the superior power of hot-air enables the smelter to practice. For instance, there is a greater waste in re-melting hot-blast iron, whether for the foundry, or in the refinery. Neither does the suggestion of the increased use of refractory ores clear up the difference; refractory, in its ordinary sense, implies infusible, and it is actually this class of ores that are the most beneficially treated with hot-air. If an ore or ironstone be of a favourable composition, so as to be readily and perfectly reduced by cold blast, heated air will increase the quantity but not the quality of the product. But if the materials be refractory, whether the fuel, as anthracite difficult of combustion from its density, or ores infusible, for instance, from excessive mixture with unalloyed lime, such as the ores of the western side of Dean Forest, or the similar ores of the Welch carboniferous limestone at Pentyrch, both quality and quantity are improved by the use of heated air. There are many other parts of the kingdom where better iron is made, under similar causes, by hot than by cold blast, because, as a general rule, that degree of temperature, and neither less nor more, which is just sufficient to perfectly reduce the materials, makes the best iron. A less temperature seems to leave something undone, and a greater, to do something too much. The general state of the case would, therefore, be more correctly given by attributing the deterioration of quality under hot blast, not to the use of more refractory ores, for these suffer the least under these conditions, but to the greater quantity and mixture of rich ores in proportion to fuel which the heated air permits the ironmaster to use, and of this mixed quantity it is the *least* refractory ores which sink the fastest below the tolerable minimum of quality. That, *as a rule*, cold blast iron is best calculated for the highest qualities of malleable iron, is a fact so well established, that it is not, I presume, intended to controvert it. Yet it is just as unlikely that we shall go back to cold blast practice in search of quality, as revert to the still better antiquation of charcoal smelting. Indeed, the improvements called for in this paper, are evidently intended to be united with the retention of the hot-air system, and therefore it is the more important to look candidly and distinctly at its inward and characteristic effects or defects. The much greater increased produce which it enables us to obtain from the same labour, fuel, and plant, has quite diverted attention from the previous attempts to introduce economical processes between the blast furnace and puddling furnace—in fact it has had a large share in sweeping away the old refinery standing between the two, and I am therefore the more inclined to think if any effectual improvements arise, they will not go further back than the puddling furnace.

I should much like to see a specimen of the carburetted cast iron produced in the *upper part* of the Catalan fire, and quite agree that the coke used in the congeners and subspecies of this furnace, should be free from slate, or what is in domestic science termed "slat." The correct recommendation will be generally acquiesced in; but the absence of sulphur is a fully more valuable and difficult attainment.

I would here remark upon a species of phraseology by no means peculiar to this author, but which I think tends to convey wrong ideas, as a perversion of those chemical terms, intended to express definite chemical compounds, and therefore inapplicable to the description of mere mechanical mixtures and alloys. The terms silicates and sub-silicates, for instance, are much used in this paper, as if they had a definite signification. Chemical union takes effect in definite limited proportions, giving rise to new substances, and new distinct properties; this is the great atomic law of definite equivalents, and the results are as definitely characterised. But alloys seem to be quite a different matter. Sand or silex may be mixed or melted with oxide of iron into a slag in any proportions whatever, from a unit or a fraction of a unit of per centage. Lime and clay may be added in equally indefinite proportions to effect an *ad libitum* variation of the slag, inconsistent with chemical equivalents. It is common to hear glass called a silicate of potash, or blast furnace slags silicates of lime, but how can this correctly be? silex, potash, soda, alumina, lime, and other matters, may be indefinitely melted into a transparent glass; oxide of iron, sand, clay, lime, magnesia, anything or everything capable of fusion, will unite together into a blast furnace slag. These alloys can hardly be called even solutions of the one substance in the other, for there is no evidence of either being absorbed without increase of bulk in the pores of the absorbing component. The nearest approach in these igneous alloys to a solution, seems the union of carbon and iron. Iron may be assumed to *dissolve* carbon from the most minute dose through the various stages of steel, white iron, mottled iron, up to a degree where the iron appears to be saturated, and the carbon "crystallizes out as graphite." And if we apply the pretty general law—that the solvent power of fluids is in proportion to their temperature, we have an explanation of the higher carbonizing capacities of heated blast, its probability being enhanced by the fact that the graphite or *kesh*, is developed in the hearth below the blast, where the heat of the fused metal must be less than in the higher super-saturating region. Under this reduction of temperature, the iron parts with some of its dissolved carbon in *flakes*, which prove its liberation under stratified pressure. But there is no trace of any action in the heterogeneous components of a slag which can exceed, if, indeed, there is anything which can approach, even this vague degree of solution. Lime, indeed, if it exceeds about 40 per cent. of the silica in a transparent glass, will be seen in white, opaque spots, either undissolved, or unfused, or *crystallising out*, like the mottle of pig-iron. But none of these suppositions will even approximate to the definite intention of chemical phraseology, to express the formation of definite compounds from definite amounts of elements, and the use of such terms misleads, by giving an appearance of importance to what has none, and leads to vague and incorrect reasoning. We might equally call brass a zincite of copper, or sovereigns sub-copperites of gold. The hybrid terms of modern chemistry are an intrinsic injury to the simplicity of language, and only permissible where the inconvenience is balanced by the conveyance of an exact idea. Our more profound writers are always seen to make as little parade as possible of scientific phrases, figures, and symbols. Slag is a good word to express a heterogeneous, accidental compound of metallic and earthy fused oxides, and is familiar, and it is short. Not much would be gained in science, and very little in utility, by calling strong paste a flourite, and weak paste a sub-flourite of water.

As a whole we are greatly indebted for this paper, and the pains which the author has bestowed on it. Iron is a hard and heavy subject, requiring no slight effort to handle, and proportionate thanks are deserved by the attempt. Even the deficiencies of the paper have already been of service in prompting others to indicate those parts in the comprehensive outline which require particulars to be filled in. The very defects appear to arise from a too-willing disposition. Had the author done less he might have done more, and given us tangible details of comparison in matters only hinted at. We cannot put our finger on a single detail of foreign practice, so as to be enabled to say this is either better or worse than ours. Indeed so little is his case made out, that though I went to the room fully disposed to agree with Mr. Blackwell's general position, I left with a different impression. In the absence of any close research into foreign processes, or copious exposition of foreign improvements to date, there remained only the unsupported assertion that in general they did better than us and we worse than them. A considerable sensation has been maintained by the public press that great advances had latterly been made abroad, but there is nothing described in this paper but what has been long known, or has been actually imported from this country, and the inevitable conclusion is, that there are no such great novelties when none of them are brought to support a special case. If there had been even an elucidation, *pro* or *con*, of the current assertion that economy of production in France was so successfully cultivated that it was expected productive duties would soon become unnecessary to the native manufacture, we should have had something; but in truth, as everyone has remarked, the title of the paper and the contents do not correspond. I only hope that the commercial comparison which we were led to expect, and which Mr. Blackwell declared himself unqualified to attempt, will be taken up by Mr. Bird (as hinted), or by some other competent person, for it is the feature to which all the details are mere subsidiary accessories. A right title would have been:—"A Description of the Ironmaking Materials of Great Britain and some Foreign Countries: with a Verbal Map of their Geographical and Geological Position; some Abstract Remarks on some of the Ironmaking Processes of this Country; and a Comparison of the Exposition made at Paris by Ourselves and by Foreigners." The comparison is solely limited to the Exposition, and here, I must confess, I thought Mr. Bird upset Mr. Blackwell entirely. I think Mr. Blackwell right in asking, at such a display, to have the series of minerals from which the iron exhibited is produced, and Mr. Bird seemed to have entirely altered his opinion on the importance of that addition, but either the absence or presence of such a collection is a mere matter of packing and carriage, and has no bearing on our respective trades. They are interesting, and not much more. The gigantic rails, which Mr. Blackwell stigmatised as so inconvenient a barrier to the examination of minutiæ, are, to my mind, true exemplifications of the iron manufacture of this country. They illustrated not only the power of our machines, but the physical strength and capacity of our workmen, and were truly national displays. Any child of any country may gather specimens of coal and stone. Nations with limited capital are forced to unite in their works various branches of manufacture, and it was not to be expected they would leave out any of these when exhibiting on their own soil. Mr. Bird appreciated the articles from Eschweiller at their exact value; the real feature distinguishing these works, their economical arrangement, was less capable of being exhibited. Indeed, in that respect, Mr. Blackwell might seize an opportunity to draw a heavy argument against our "lazy diligence" in treading our own beaten paths. Some years since, after these works had been completed and known in this country, a large mill, equal to 1,000 tons of bars weekly, was erected in Wales, and Mr. Blackwell present at the opening, with all the old-fashioned lumbering appliances and heavy driving shafts, wasting the transmission of distant power. Whoever may take up the important task of completing the desiderata which have been called for on this most extensive topic will I trust favour us with a more liberal reference to authorities. It is inconvenient to have so much depending upon the thread of a mere *ipse dixit*. The discrepancy between Mr. Blackwell and Mr. Bird on the priceing of British exhibits, strongly enforces the necessity of such a course to correct those errors to which we are all liable. From his position as Commissioner, there can be no question Mr. Bird had the right story, and there are other statements where I happen to be intimately conversant with facts and localities, which lead me still further to recommend, as a most valuable feature in a discussion of this kind, a free, copious, and unhesitating reference to open and original sources.

Jan. 26, 1856.

P.S.—Errata last week in "Cort's Inventions," p. 181, 17th line from bottom, for *James* read "Samuel;" 5 lines further, for *with* read "into;" next line, for 1754, read "1782;" p. 182, 11th line, for 1798, read "1788;" 25th line, for *Mr. Banks*, read "Mr. Black." I ought also to have discriminated that it was the puddling furnaces *only* at Cyfarthfa, Penydarran and Dowlais, that had been in operation before the extent in aid. The rolling mills took some months more to complete, and then the mandate was issued to destroy "the little mill at Fontley."

Biographical Notice.

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ARCHIBALD BUCHANAN,

OF THE CATRINE COTTON WORKS, AYRSHIRE.

The subject of this memoir was the youngest child of James Buchanan, a small landed proprietor of Carston, Stirlingshire. He was born in 1769, his mother being then 50 years old. In 1783, when about 14 years of age, he was seen at the house of his brother, in Glasgow, by the celebrated Sir Richard Arkwright, of Matlock, Derbyshire, and at the particular request of this gentleman, he was sent to him to learn the art of cotton spinning. His mother (at that time a widow) despatched him with a herd of cattle to Sir Richard, for the purpose of defraying any expense to which he might be put on her son's account.

It may not be out of place here to state, that when on a visit to the late Mr. Arkwright (son of Sir Richard) in the summer of 1818, Mr. Buchanan saw an old man working in the garden who had accompanied him as an assistant drover in 1783.

Archibald Buchanan remained for a year at the works of Sir Richard Arkwright, who, during the latter part of this period, confided much to his care, and took him into his own house to reside.

On his return to Scotland (being then under 16 years of age) he took charge of the Deanston Cotton Works, near Doune, Perthshire, the property of his brothers. During his sojourn there he assisted a neighbour, Mr. Fergusen, of Lundie, parish of Kilmadock, to produce a thrashing machine, which must have been about the first of the kind in the country, and as a proof of its excellence, it may be mentioned that this machine was actually in use until about the year 1840.

At the end of the last century, the Ballindallock Cotton Works, Stirlingshire, having been purchased by Messrs. James Finlay and Co., Mr. Buchanan joined them, and took the management. While residing here, he married Miss Ellen Robertson, daughter of the Rev. Louis Robertson, of Dunblane, Perthshire. By this lady, whom he lost in 1807, he had two sons, James and John, who appear to have inherited the mechanical genius of their father, and have, like him, become inventors and patentees.

In 1801, Messrs. James Finlay and Co. became the proprietors of the Catrine Cotton Works, Ayrshire, and Mr. Buchanan removed there as managing and resident partner. He soon afterwards acquired the three small properties of Daldoreh, Over Catrine, and Shaw Mark, on the former of which he built a suitable residence, naming it Catrine Bank.

At the end of the year 1810, Mr. Buchanan was again married. His second wife was Miss Hannah Struthers, a younger sister of Mrs. Kirkman Finlay, the wife of his partner, the latter being at that time Lord Provost of Glasgow, and M.P. for the borough. By this lady, who still survives, he had one son, Archibald, now his father's successor at the Catrine Works, and four daughters, two only of whom survived their father.

Mr. Buchanan became well known not only as a successful spinner, power-loom weaver, and bleacher, but also as a man of high mechanical acquirements, and considerable experimental knowledge in agricultural pursuits. One of his most valuable efforts was the great improvement of coupling, on the same crank shaft, the two engines of 40 horse-power, at the Catrine Works, about the year 1814. So doubtful of the effect of this experiment were engineers generally, that Mr. Cook, of Glasgow, (then one of the first engineers of the day) who fitted up these engines, declined to be responsible for the result.

The idea of combining the two waterfalls at the Catrine Works into one, produced the famous wheels still at work there of 100 horse-power each, 50 feet in diameter, and 12 feet wide. Being in want of proper parties to execute a job of such magnitude, Mr. Buchanan went to Manchester, and at the suggestion of his friend, the late John Kennedy, he employed the then rising firm of Fairbairn and Lillie, of which the now celebrated William Fairbairn, C.E., was a partner.

Mr. Buchanan made some important improvements in the dressing machine for preparing warps for the power-loom. (See White, "On Weaving by Power," page 143, published at Glasgow, 1847.) He obtained patents for two of his inventions. The first, No. 4,854, 16th October, 1823, having, for its object, to produce a variable speed in the vibration of the lay or batten, so that the lay may be as nearly stationary as possible while the shuttle is passing through the shed, and may move with a rapid smart stroke when beating up the weft, thereby permitting the loom to be driven at a greater speed. His second patent, No. 4,875, 4th December, 1823, was for an improvement in carding engines, whereby the top cards were regularly stripped and kept clean without the aid of hand labour. The speed of his looms generally was greatly increased long before those belonging to the rest of the trade. (See Mac Phun's *Glasgow Mechanics' Magazine*, No. 8, 1824, and No. 20, 1825.) His carding engines continue in use at the Catrine Cotton Works and elsewhere, and some are even now in course of construction by one of the first makers in the trade, the self-topping movement being still considered to be the best. At Catrine, the self-acting mule, which was designed and erected by him in 1826, first succeeded satisfactorily.

As a practical farmer, he was one of the first to adopt the system of under-draining, which he applied about the years 1822 and 1823, to the small estate of Daldoreh, making drains twenty inches deep at every twelve feet. His celebrated nephew, the late James Smith, of Deanston, had in early life acquired his farming, no less than his mechanical knowledge and tastes, from his uncle. (See *Journal of Agriculture*, No. 30, New Series, pages 458 and 463, October, 1850, and *Chambers's Edinburgh Journal*, for June 28, 1851, No. 391, New Series, page 408.)

Mr. Buchanan long acted as a Justice of the Peace and Commissioner of Hipply, in the County of Ayr.

In his earlier years, Mr. Buchanan served in the Stirlingshire Yeomanry Cavalry, and, subsequently, in the Ayrshire Local Militia. His father, James Buchanan, of Carston, when with his regiment, the Scotch Greys, in England, for the first time saw lime used on land, and, subsequently, he adopted this process (then unknown, at least in this part of Scotland,) on his paternal property. He was also the first who had a wheeled cart to the north of the River Forth.

Mr. Archibald Buchanan continued to reside at Catrine Bank until his death, which took place in the spring of 1841.

Colonial Correspondence.

ADELAIDE, SOUTH AUSTRALIA.

The Secretary to the Adelaide Philosophical Society, writing under date of the 18th October last, says that the "Society is at present endeavouring—I hope successfully—to organise, with the assistance of Government, an exploring party, to ascertain the nature of the country in the north-western region of this province, which comprises an area of 150,000 to 200,000 square miles of entirely unexplored territory."

THE NATURAL RESOURCES OF BRITISH HONDURAS.

Belize, British Honduras, Dec. 17th, 1855.

SIR,—The Boreal breezes have set in; the morning air is fresh and cool, the quicksilver in the thermometer ranging from 65° to 72°,—flocks of teal, and duck, and snipe have paid us their hiemalian visit, and may be seen in thousands at daybreak in the various swamps and lagoons with which this country abounds—and bare-legged sportsmen wading up to their middle, with guns at full cock, are stealthily approaching them, with a view of enfilading about a hundred at one shot. Sambo never dreams of shooting his game when it is upon the wing. Such a preposterous idea never enters into his wool-enveloped cranium; he prefers to take them sitting, and never fires until after a deliberate aim of at least a minute. The teal of this country possesses a very fine flavour, and it is usually exceedingly fat. The ducks are much inferior, the flesh being coarser, and the taste rather insipid. There are four different kinds of ducks in Honduras: they are the wild Muscovy duck, the gray-bellied duck, the whistling duck, and the English wild duck. The wild Muscovy duck is a large bird, about the size of a goose; and, excepting a slight tinge of a sort of invisible green upon the back and the curve of the wing, quite black. I have heard it highly spoken of, but it is not good eating,—it is coarse, tough, and tasteless. The whistling duck, in point of flavour and fatness, ranks next to the teal, but by no means comes up to it. Snipe and woodcock are abundant at this season. The former is equal to the English snipe, but the latter is a very inferior bird. This species of game is seldom exposed for sale, for being shy cocks, they are not to be caught sitting, and that is the only posture in which they may consider themselves in danger; as long as they are cleaving the air they may feel assured that they are all right. An exceedingly estimable member of the feathered society may also be found luxuriating in the pools and swamps at this period of the year—it is called the clucking hen. It is a branch of the numerous and respectable family of the cranes, has stilt-like legs, a long bill, and is about the size of a small domestic hen; the skin is thick and leathery, but the flesh is white and delicate. This bird possesses the extraordinary power of producing a note similar to the tinkling or tolling of a distant bell. In passing along the rivers at night, travellers are often startled by this sound, and give way to various conjectures. The story of Ralph the Rover, and the Monks of Aberbrothock, comes to one's mind, and though we don't go so far as to believe that—

> "The devil below is ringing his knell,"

yet that strange tinkling heard at midnight in the depths of the forest, where there is no human habitation, and probably never was since the world began, breaking the stillness of that dark and quiet hour, has a mysterious sound, and is well calculated to produce uneasy thoughts in the minds of the ignorant, and inspire them with a superstitious dread of the tangled recesses of the leafy wild. I have forwarded to you by this packet the preserved skin of one of these birds, also one of the whistling duck, ditto the gray-bellied duck, ditto the English wild duck, ditto the Honduras snipe. I have also sent you a curious fish, of the crustaceous tribe, which is found in these waters. I am unable to give it a "name," though I tell you its "local habitation."

In a former letter I mentioned that a tree, called the Ebo tree, grew on the Mosquito shore, from the nut of which an oil was extracted, which was considered to be extremely nutritious to the hair. I have been fortunate enough to procure a bottle of this oil, which I now forward to your Society. I can, myself, form no opinion whatever of the merits of this extract, but I have little doubt that it is a valuable production. I have never seen the Ebo tree, and I have not the least idea what description of tree it is. I am pretty certain that it has never been found in British Honduras, although it is, I am informed, very plentiful in the Mosquito country. I have sent to you, along with the articles above-mentioned, a considerable quantity of the snake root, and also a bottle of its tincture. The latter will require to be strained before it is used. I was at first led to believe that it was the real guaco, but I am now convinced that it is not. I should much like to know the opinion of medical men in England of this root; that it possesses certain very powerful medicinal properties there can be no doubt—its intense bitterness is a proof of that—but whether it can justly lay claim to the curative virtues which have been ascribed to it, is a fact which requires to be ascertained. In my opinion, it is the duty of the pathologist and the analytical chemist to make strict inquiries into the character of every material, vegetable or mineral, which is believed, rightly or wrongly, to be a remedy for any disease. Accident has given birth to some of our most valuable discoveries, and the effect of every medicine must be ascertained by experiment. A universal practice amongst a people, however ignorant and uncultivated that people may be, of swallowing the juice of a certain plant, or the powder of its bark, as a remedy for a particular disease, must have originated in an accidental cure, or supposed cure, having been effected by it. Its medicinal properties could not have been communicated by revelation, nor could a knowledge of them have been arrived at by any process of reasoning. We do not possess a more valuable medicine than quinine, which in damp and unhealthy climates has saved so many thousands of lives. It was by the purest accident that the medicinal virtues of the Peruvian bark—from which quinine is made—were discovered. A poor sickly Peruvian, one minute shivering with ague, the next scorched by fever, rushed to a pool of water which was in the midst of the forest, to slake his burning thirst. It was the Bethesda of the wilderness. The naked Indian drank greedily of the water, it was bitter to the taste, but it expelled the fever. It was found that some trees, afterwards called Cinchona, from the Countess del Cinchon having been cured of ague by the bark of a similar tree, growing upon the margin of the pool, had fallen into it, and had imparted their medicinal virtues to the water.

There is a plant which grows very commonly in Honduras, an infusion of the root of which is used by the negroes for disorders of the stomach. I am ignorant of its name, but I will endeavour to describe it. It is a low-spreading shrub, having a long slender stalk covered with blunt thorns, at the end of which is a yellow flower, about three inches long. This flower is singularly formed. The upper part of it is compact and waxy-looking, the leaves overlapping each other, and giving it rather the appearance of an acorn. Underneath this there are eight or nine oval buds, the size of the kernel of a filbert. At the bottom of all is a group of half-opened, timid-looking, yellow flowers, a little lighter than the buttercup and a little darker than the primrose. The leaves are somewhat spear-shaped, and a dozen or fourteen grow upon one branch. The pod is from three to four inches long, serrated at the edges, and having a high ridge running down the middle on both sides, and a sharp but flexible thorn at the end. I have sent you two roots of this plant. I wish I could send the plant itself, for in England it would be considered very pretty. I will, however, send some of the seeds as soon as they are ripe.

The ground nut, or pindar, is cultivated here to a considerable extent. I believe that a valuable oil is capable of being made from this nut. I have been informed that large quantities of pindars are exported from the Gambia, and other African settlements, to France, for that purpose. I see no reason why Honduras should not compete with them in this article of trade. The pindar, when roasted, is an agreeable nut to eat.

The cashew tree is very common in Honduras. It bears a fruit like an apple, at the end of which is a nut of the shape and size of a rabbit's kidney. This apple has a mawkish, sweetish taste, and a greater astringency than any other fruit with which I am acquainted. A little of the juice, however, squeezed into punch, greatly improves that "time-honoured" beverage, which, according to the Ordinary of Newgate, "is nowhere spoken against in Scripture." The shell of the nut is extremely hard, and it has an internal coating, or membrane, containing a caustic juice, so powerful, that if the lips come in contact with it, the skin will be instantly burnt off. The kernel is most delicious, whether it be roasted or eaten raw. It unquestionably contains a very rich oil.

A fish is caught at the mouths of some of the rivers in this country, which, if salted, might, I think, be turned to some account as an article of trade. I allude to the calipever. This fish is considered to be the salmon of the tropics, and, indeed, it very much resembles that prince of the finny tribe in its size, shape, habits, and flavour. The flesh, however, is not red, neither is it so firm as that of the salmon, but it is quite as fat, and infinitely more juicy and delicate. When cut in slices, folded in tissue paper, and lightly fried—which is the only way, in my opinion, of dressing fish, the flavour of which is so volatile, so subtle, so ethereal, that it more resembles an odour, or the rich fragrance of a thousand different flowers mixed and mellowed by distance, than an actual taste on the palate—nothing can surpass it. To subject it unprotected to the ferruginous influence of an iron pan, would be the act of a Hottentot, or a Tartar. Dressed in the manner I have mentioned, it would not have disgraced Olympus, nor offended the critical taste of the Apicii, the last of whom would have refrained from hanging himself whilst a single calipever remained in his fish-pond. The calipever is very excellent when cured, and it is often brought in that state to the Belize market in large quantities. The roe of this fish is very superior, and, I think, almost equals caviare. This is dried, and sold separately. The roe of the calipever is worthy of the consideration of Messrs. Fortnum and Mason.

I have sent you another sample of the rice of this country, and I should be glad to know what is thought of it. There are large tracts of swampy lands in Honduras which are capable of producing rice, but nothing else. If the rice, then, be of a good quality, these swamps would not be altogether lost to the human race.

I have the honour to be, sir,
Your most obedient servant,
R. TEMPLE.

Home Correspondence.

IRON FOR ORDNANCE.

Sir,—The guns that did not wear out on board the experimental vessels of 1795, were carronades. It is hoped that some of your correspondents may still be able to state whether the fuel used by the Carron Company was mineral or vegetable coal. The ascertainment of this fact would go far towards settling the question respecting the need of charcoal for the casting of iron ordnance.—I am, truly yours,
M. S. BENTHAM.

25th January, 1856.

REPLY TO COLONEL BAKER'S REPORT ON COLONEL ARTHUR COTTON'S PAPERS ON THE MATERIAL IMPROVEMENT OF INDIA.

Sir,—In the 136th Number of the Society's *Journal* of last year, the Report of Colonel Baker, secretary to the Government of India, in the Public Works Department, was printed, giving an opinion on the views contained in the papers I have published on Public Works in India. This Report was made in obedience to orders from Lord Dalhousie, the Governor-General.

The Council of the Society of Arts having already shown their appreciation of the subject by inviting me to read a paper upon it, and having further honoured me with their silver medal, I trust that some further discussion of the question will not be considered unprofitable. It is indeed impossible to estimate the importance to this country in every way, and especially in respect of a market for its manufactures, of the material improvement of India; and consequently the investigation of the question, how money may be expended, so as most rapidly and effectively to attain to this, is certainly worthy of any amount of labour, even supposing that it was not a matter of the highest duty and interest to benefit to the utmost so many millions of our fellow subjects.

Before making any remarks on the Report in question, I may observe that the leading points which I have endeavoured to prove in my papers, as fundamental ones in the question of the improvement of India, were:—

1st. That the first thing for India, as for every other country, is to secure, as far as possible, cheap food; that is, that only a small portion of the community should be employed in raising food and the other necessaries of life.

2nd. That after cheap food, the next great desideratum is cheap transit, so that everything may be procured from the localities where, from natural facilities, it can be obtained with the least labour.

3rd. That in a tropical climate, no means for cheapening food can be compared with the application of water in irrigation, by which at least four times the quantity of food, as well as other produce of the land, can be obtained as by cultivation dependent upon the local rains.

4th. That water carriage is much cheaper than any kind of land carriage, and that for very cheap transit no other means can be used but water. Upon the most extensive scale it is proved, both in England and America, that even railway transit, with the help of steam power, is from three to four times as costly as internal water carriage with animal power.

5th. That no kind of transit that is more costly than water carriage will answer for the heavy traffic of a great continental country like India, where the distances are so considerable, that the great mass of the traffic cannot bear the cost of railway or any other land transit, even with the aid of steam power.

6th. That railways worked with quick trains cannot convey the *quantity* that ought to be moved in an extensive country like India with an enormous population. Even in its present state, without even common roads, the traffic on the Ganges is reckoned at 2,000,000 tons per year, while the most crowded railway in England only conveys on an average, over its whole length, 200,000 tons a year, and perhaps not more than 400,000 tons over its most crowded part.

7th. That in the present state of India, while almost wholly unprovided with *cheap* transit, *speed* is, comparatively speaking, quite an insignificant object. To carry travellers at a high speed, while the country is without the means of carrying its goods to market cheaply, is exactly like a farmer keeping his carriage before he has got a waggon.

8th. That even England, the wealthiest country in the world, cannot yet afford high-speed railways, as proved by the fact that money so invested, after a full trial of many years, yields, on an average, less profits than any other kind of speculation whatever. And, therefore, it is certain that an extremely poor country like India cannot yet afford such a luxury.

9th. That what India wants, in the first place, is extensive irrigation and water transit (wherever possible) in *every district*, and not in this or that particular locality.

10th. That there are from 8,000 to 10,000 miles of river at this moment available for navigation, in a more or less perfect degree, and that to improve them, so as to make them thoroughly effective lines of navigation, conveying goods at a quarter or one-eighth of the cost of any land carriage, would not cost more than £100 or £200 a mile, or from a fiftieth to a hundredth part of the cost of the present railways. And hence, to throw away this enormous natural advantage, worth from £50,000,000 to £100,000,000 sterling, and expend our time and money upon railways at the rate of £10,000 a mile, is one of the greatest mistakes that ever was made.

11th. That water is India's greatest natural treasure; that it can be brought upon the land, or used for water carriage at an *expense* not exceeding one-fiftieth or one-hundredth part of its *value*, while the richest gold mines in the world do not yield more than four times the value of the labour bestowed upon working them.

12th. That the actual results of money expended in irrigation works, from the smallest to the largest scale, prove, beyond all room for doubt, the vast difference between the *cost* and *value* of water in India.

13th. That, where the nature of the country and other circumstances render canals unadvisable, cheap low-speed railways should be laid down, as the next best kind of communication for a country which cannot afford high-speed.

14th. That to suppose we are *opening India*, when we are laying a few hundred miles of high-speed railway, in three or four lines, is the most complete delusion. That it is not one line of communication through 20 or 30 districts out of the 120 which India contains, nor even one line through every district that will *open India;* every district requires to be provided by a network of communications. The great bulk of India cannot afford to wait for 20 or 50 years while a single line is opened through a few districts. What does it signify to Gunjam that a railway is making in the presidency to which it belongs, when that railway does not come within 600 miles of it.

15th. Speed of transit over a few hundred miles of communication, is a matter of utter insignificance compared with speed in throwing open the whole country to all the wholesome influences of cheap transit, opening the way for European enterprise and capital into every district.

16th. Beggars as we are, it is of the utmost importance that we should consider well how we can spend our time and money with the greatest effect. To jump at the conclusion that, because England chose to spend £300,000,000 to enable her to travel at 40 miles an hour, therefore, it was the most prudent thing for India to do the same, was just as wise as for a poor man to starve himself and his family for years, while he spent his money in travelling like a gentleman for a few days now and then.

17th. That upon this improvement of the resources of India by a *judicious* expenditure upon public works, depends the providing the necessary funds for supporting an effective government, for education, and for every other purpose essential to the welfare of the country.

18th. That the expenditure on public works should be kept quite distinct from the other expenses of the state; capital employed in productive works being essentially different from ordinary government expenditure.

19th. That to execute an adequate system of public works out of revenue, is impossible, and were it possible it would be most unjust to make the present generation pay for that in which they had only a life interest. Almost the whole of the public works of England have been executed by capital on loan, and which is a debt to this day.

It seems to me essential thus, before proceeding to remark on Col. Baker's paper, to show distinctly what the real question is. All the points thus remarked on by me are, as I think, substantially argued out and supported by patent facts.

Now does Col. Baker disprove these things? are his own conclusions contrary to them, and are they substantiated by facts and arguments?

His conclusions are as follows, and I add a short remark upon each:—

1st. "That an imperial system of transit lines of railway, such as have been lately sanctioned, is essentially necessary to meet the military, social, and political requirements of India." No man more heartily agrees with Col. Baker in this than myself, but what in the world has this got to do with the real question, viz., what should *first* be done for India. A patient is bleeding to death, and a spectator begins a long discourse on the best mode of treating him so as to restore his strength, but another says, "Stop a minute, let us first stay the bleeding."

2nd. "That the greater expenditure on high-speed railways is chiefly for objects conducive to cheap working." This is the first time I have seen such a statement, and I feel fully assured that high-speed was the real object, and that if it had not been, nothing like those sums would have been expended on the railways.

3rd. "That the ordinary traffic of high-speed railways should be worked at that speed which will secure the most economical results." Of course, so far as is possible, while the goods trains are pursued by fast ones, obliging them always to work at too high a speed, and eventually to turn into sidings besides, and wait for hours, often for 18 or 20 hours. But what has this to do with the real question?

4th. "That a heavy traffic can be worked more cheaply on a substantial railway than on an inferior one." No doubt, *if they were both worked at the same speed*, but an inferior railway, without any fast trains, can be worked much cheaper than the best with them.

5th. "That a low-speed railway should be worked by animal draught, though made fit to be worked on emergency by light engines." I have nothing to say to this, but that settling a thousand such minor points would not bring us any nearer to our object.

6th. "That the guage should be 5ft. 6in." The same remark applies to this.

7th. "That such railways were applicable only as branches to trunk lines, and in localities where the traffic is light." Or, he might have added, where we cannot yet afford to have such as will cost more time and money.

8th. "That activity of construction being dependent on the supply of iron, may be four times greater for an inferior railway than for a superior one." Then he grants the whole question about high-speed and low-speed railways. For I am sure no one can show that it would be better to have 1,000 miles of high-speed railway than 4,000 of low-speed, or 10,000 of the former than 40,000 of the latter, or 100,000 of the former than 400,000 of the latter.

9th. "That the system of coast canals, proposed for the Madras presidency, appears to promise very beneficial results."

10th. "That canals in situations suited for their construction are preferable to low-speed railways." These conclusions also have little to do with the question.

11th. "That great speed in canal and river navigation is not likely to be attained in India." This, also, is not the question. It is certain that a speed fully sufficient for our main present purpose is attainable—a speed of from three to eight miles an hour.

12th. "That the improvement of rivers and formation of canals will not tend immediately to extensive boat navigation where it was before unkown." Somebody well remarked, if there is a man in the world that knows the difference between 99 pice and 100, it is a native of India. Only make a water communication that will carry in the least degree cheaper than the land one, and no people upon earth would sooner take advantage of the opening.

13th. "That the most perfect system of railways and canals will not supersede the necessity for good cart-roads."

It will be seen, on comparing these conclusions with the points I have remarked upon, that most of them do not really at all meet any of the great points. And that as to the essential questions, Whether irrigation is the grand means to relieve the people from their present enormous labour in procuring the necessaries of life, about which three-fourths of the population were now employed? Whether it is advisable at present to spend millions upon high-speed railways, rather than upon irrigation, navigation, and low-speed railways? Whether the high-speed railways can carry the great traffic of the country? Whether the cost of transit on these railways will not prevent five-sixths of the traffic there ought to be? Whether it is not the greatest mistake and injustice to leave 100 districts almost untouched, while a single line of communication is made at an enormous cost through the remaining 20? Whether the general improvements of the country by means of irrigation and cheap communications is not the only thing that can provide funds for all other improvements? As to these essential questions, literally not one word is said, yet these were the questions raised, the questions upon which Lord Dalhousie wanted a careful opinion, and (as I must insist) the real questions upon which the welfare of India depends.

Having thus called attention to what Col. Baker does not say, a very few words will suffice for what he does say, as it is my particular object not to lead people away and occupy their attention with matters of comparative insignificance. This has been the grand mistake hitherto; while men have been discussing *what the guage ought to be*, they have forgotten that not one hour had been given to the discussion of the question whether railways ought to be commenced upon at all in preference to any other works.

I must notice the candid and perfectly honest way in which Colonel Baker has remarked upon my papers, so honourably contrasted with the tenor of the writings or speeches of others who have attempted to oppose my views. Colonel Baker commences by stating that "the consideration of this question has left me deeply impressed with the importance of the subject, and though I dissent from many of the views expressed by Colonel Cotton—and though I dispute many of his calculations, I cannot but feel that he argues from sound principles, and that his plans for the improvement of communications at small cost in some localities, by means of canals and rivers, and in others by an inferior class of railway, are eminently deserving of attention."

In the 3rd paragraph, with respect to the data on which my calculations are made, of course I was under the necessity of arguing from such data as we had. With respect to new works, especially those of irrigation, we have abundance of conclusive data; for others, such as railways, we had no Indian data to signify, and I could only argue from those of England and America. But we must begin somewhere, and till we have conclusive data, we must make what use we can of such as we have. The difference between the railway men and myself is, that they at once began to lay expensive railways without any discussion whatever; I investigated the subject as far as I could by means of such data as we had, and showed that these data were quite sufficient to prove this, that it was a grievous mistake to spend £10,000 a mile upon railways that would neither give us cheap transit, nor carry a quarter of the traffic that ought to exist.

Colonel Baker says nothing in answer to any of the fundamental calculations or arguments, from which I conclude that they were unanswerable, but then he should surely have acknowledged the legitimate inferences—viz., that money ought first to be spent in navigation and cheap lines of transit.

In the following paragraphs he compares a low-speed with a high-speed railway, and intimates that the former could be constructed for one quarter of the cost of the latter, which, as I have before argued, clearly decides in my favour—viz., that the former ought to be executed in preference to the latter.

The only further remarks that it seems necessary to make in these paragraphs, are these:—1st. Colonel Baker does not seem to be aware that all passenger railways are worked at a speed for goods above what is economical, and that what with pushing on the goods trains at high speeds, and keeping them waiting for hours in the sidings, the waste of money is enormous. 2nd. I do not propose any one kind of railway for all lines. I would make them of various weights of rail, &c., to be worked with light engines or animals according to the circumstances of the case. 3rd. Colonel Baker is entirely mistaken in supposing that American railways are worked at nine-tenths of a penny per ton per mile, and English ones at one farthing, "in consequence of the latter being more solid structures." Goods are carried at a less *cost* (not *charge*), on American railways than in England, because, having few passenger trains, and those (excepting on a few lines) worked at lower speeds than in England, the goods traffic is not so much interrupted. No goods are carried in England at one farthing a ton, and it is pretty certain now that there is no actual profit (on the passenger lines) on goods carried at one penny. I had myself supposed that the statements that goods could be carried at one halfpenny per ton in England were true, but I find that they are quite false. A railway official thoughtlessly, one day, explained this by saying, "We were obliged to charge only one halfpenny a ton for the transit of *our* coals, because the price we sold them at would not allow more." When the railway companies are also coal merchants, nobody can say how the matter really stands between the two trades they carry on. Just as it was with the East India Company formerly, when they were both kings and tea-dealers.

A gentleman whom I asked about this point, and who had managed the conveyance of 100,000 or 200,000 tons a year, told me that the total expenses were rather under a penny, on a road that was worked at low speed, and with little interruption from passenger trains. But the result of much inquiry is, according to my opinion, that, allowing for wear and tear, management, accidents, and other items at a fair price, goods cannot be carried profitably in England, where there are many fast passenger trains, at a penny a ton. And the increase of goods traffic, accompanied with a diminution of dividend, which is now so general, is a strong support to this conclusion. In the late railway reform meetings, it has been declared by all, that goods were carried at a loss on the English railways. 4th. Colonel Baker thinks the Calcutta railway will only cost £8,000 a mile, but the 120 miles already opened have cost at least £120,000; and the managing director of the Bombay railway says that line will cost £10,000 per mile on an average. 5th. In Colonel Baker's estimate of the respective *charges* that must be made on a low-speed railway, he makes the mistake of supposing that the same *quantity* will be carried at a low charge as at a high one. The fact is, that it is the great fundamental principle of transit that *the lowness of the charge produces the traffic;* probably, if the charge is reduced from four to one, the traffic will increase from one to ten. When the rate is reduced very low, as on the canals and rivers in America, enormous masses of goods of little value are set in motion, not a ton of which could move at high rates. The granite slabs of Mysore, which are not now moved ten miles, would probably be carried all over India, if there were a system of steam-boat canals conveying such goods at one-tenth or one-sixteenth of a penny a ton a mile.* 6th. What Colonel Baker says about the impossibility of carrying more than 16,000 tons of iron per annum to India, was curiously answered by a great shipowner to whom the subject was mentioned. He said, I do not know what all England could do, but I would undertake to send 100,000 tons a year. To suppose, from some momentary difficulties, that we should never be able to send out more than 16,000 tons a year, for want of freight, is absurd.

Colonel Baker next says I am unreasonable in supposing that the past rate of progress in railways will be the measure of the future. But my quarrel is not with the laying so many miles, but with their laying any at all, at present. The more they lay, the greater waste will there be. If he says that in future 1000 miles a year will be laid, then I say that the same money and labour would improve 50,000 miles of river, if there were so many, or make 5000 or 10,000 miles of canal or light railway, or irrigate so many hundred thousand acres. It is a strange argument to use, in answer to my charge, that every mile of high speed railway is a most grievous waste of money, that we are not going to lay 1000, but 10,000.

Colonel Baker next says, that my assertion is quite unfounded, when I say that its inability to carry all the traffic of the Ganges quite overthrows all the calculations of profit for the Calcutta Railway. Before he thus accused me, he should have inquired, and he would have found that the calculations of the profits of the railway were expressly made on the supposition that the whole traffic of the Ganges would be transferred to it, and upon this a profit of 18 per cent. was expected. It is Colonel Baker's assertion that is unfounded. This unfounded charge is a great blot in a paper otherwise so fair; it is evident that Colonel Baker never saw the original reports upon which the railway was undertaken. Colonel Baker says, "by this and similar arguments," &c.; I can only say that, throughout my papers, I use no unfounded arguments whatever. He goes on to argue that high-speed railways have peculiar advantages. What can be the effect of saying these things, when nobody is further from denying them than I am, but to draw away attention from the real question upon which the welfare of India so much depends—viz., is it advisable to provide a few isolated lines for high speed at an enormous expense, while the whole mass of the country is without irrigation and without cheap transit? The only other effect can be to convey a totally false idea of what I say, which I am persuaded was not Colonel Baker's *intention.*

He then, curiously enough, expresses *his regret* that one who is *apparently* anxious for the welfare of India, should direct his influence against a system which he is fully persuaded is most injurious and destructive, and against which he has brought to bear arguments which he is quite sure never can be answered. Probably nothing could have been invented more sure to hinder the progress of Indian improvement, than thus to show the British capitalist that all his horrors of Indian investment is more than justified by the exhibition of millions so expended as to leave a doubt (from the results of both the Calcutta and Bombay Railways), whether such works will even pay their expenses. The last Reports of both these works show a profit of about $1\frac{1}{2}$ per cent. per annum, while both the permanent way and rolling stock are quite new, and scarcely anything has been expended on their repairs and their wear.

Whereas, had two or three millions been expended on rivers, canals, irrigation, or light railways, so as to yield 20 or 30 per cent., it would have drawn the attention of every capitalist in England to the country.

Colonel Baker then says it is superfluous to enlarge upon the importance of river navigation, &c., which is all the answer he can find to my argument on the absolute necessity of water carriage. I must claim this as a full acknowledgment of all that I say on that subject. He says that he "allows that canals and rivers can *compete* with railways for the goods traffic." This also is calculated to misrepresent what I say. I do not say that canals can *compete* with railways for goods; I say that the *cost of transit by rail is absolutely destructive of the great traffic of a continental country*. That what Dr. Lardner says is literally true—"that goods generally cannot bear the cost of railway transit," and consequently, as shown in America, that where there is not water transit, the great mass of goods are not moved at all, and all trade in them is prevented. If it were not for the water lines from the Upper Mississipi Valley to the Atlantic, not one barrel of flour would be shipped out of one hundred that are at present brought down.

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* The Telegraph supports, 15 ft. × 18 in. × 9 in.; cost fifteen-pence each.

In his remarks on the project for cutting a canal from the East to the West coast of the Peninsula, Colonel Baker leaves out of his argument in favour of a railway, the simple fact, that if the latter were laid, the main traffic would not go by it, as it could not bear the cost of 350 miles of railway transit. Even were a railway laid, the canal would be required almost as much as it is now.

Colonel Baker's argument about the proposed weir across the Ganges, to turn the water into the Nuddeuh river is also very curious. He argues, that if the river wanders about now, when there is no artificial work to restrain it, what would it do when such works were executed; that is, if the river strays when it has nothing heavier than a grain of sand to resist it, what would it do, if an engineer put stones of half a ton in its way. I think we may safely answer, without presumption, that it would be as tractable as the Godavery, Kishnah, Cauvery, &c., now are with the engineers' bridle on them. The Santhals burnt and massacred wherever they pleased at first, but their wanderings and plunderings have not been extended by their encountering disciplined troops.

Colonel Baker speaks of this project as if it were a new and wild scheme, and makes no allusion whatever to the fact, which he was well aware of, that just such rivers, flowing through the same alluvial deposits, from one half to four miles broad, and with much greater falls than the Ganges—viz., from 1 foot to 3½ feet, (while that of the Ganges is less than half a foot), have had weirs thrown across them, and have not been permitted to wander for many years. Surely in arguing upon this point, it would have been but his duty to have given the Governor-General some reasons why he thought what had been done with exactly similar rivers could not be done with the Ganges.

Again, in his remarks about the extension of the Ganges Canal to Calcutta, he speaks of the obstacles, but says not one word on the two points, What would be the cost of overcoming them? and, What would be the value of the navigation? All such *arguments* as Colonel Baker uses amount to nothing, unless these two questions are answered. Colonel Baker gives us no estimate whatever of either the cost or the value of such a work. The Ganges Canal, with its enormous works, (an aqueduct that cost £300,000, &c.), and its vast dimensions, (60 yards broad, and 10 feet deep at its head,) has cost, I believe, under £2000 a mile. Does Colonel Baker think its extension would cost as much as the railway, £10,000 or £12,000 a mile? It would certainly be far more valuable than a railway. A single pice a mile (⅛d.) saved on every ton of the present stated traffic, (2,000,000) would give a return of £1000 a mile, the interest of £20,000 a mile, and were it executed, and goods carried at ⅛d. a ton, we may be certain that in a few years the traffic would increase to 5,000,000 tons, especially considering that the lines of communication from the interior to the Ganges would also be so improved as greatly to reduce the cost of reaching the water line.

Colonel Baker next states, more particularly, his doubts whether the natives will always take advantage of water carriage, and that the Jumna canals have not been used for the transport of goods, and that even when the government took steps to encourage the use of them, and an East Indian accepted their offers, he soon abandoned the attempt. No doubt, however, from some imperfection or incompleteness in the canal, the transit was not profitable. He adds, that the frequent failure of water at the extremity would have been quite incompatible with steady navigation. No wonder that they were not navigated. If the European engineer is so insensible to the importance of the subject, and the value of cheap transit, that he does not go to the small trouble and expense of making the canals really effective navigations, how is it possible that the natives can make use of them. Such a case occurred in Madras. The engineer turned the water out of a line of canals, in the hot weather, without giving any notice of it, and when asked why, he said it was of no consequence, because so few boats used it. If the boatmen had been asked about it, they would have said, how could we make use of such a line, when we never knew whether we should find any water in it or not.

To suppose that people will persist in carrying goods at a greater expense by land, when they could carry them cheaper by water, is surely unreasonable. He says that I stated that not a ton was carried by the Godavery above a certain point, from want of enterprise in the natives, and the interference of the petty Zemindars on its banks. It was the business of the government to remove the obstacles. The Zemindars stopped by force all boats, and levied from them whatever tolls they pleased, and so totally destroyed the value of the communication. It is just the same with such a case as it is with other improvements. If the natives had, in their present state, sufficient enterprise, they would form companies and execute irrigation works, but it is evident that as yet there are certain things we must do for them. Had the government put a stop to the oppressions of the Zemindars, I am quite sure that the river would have been as constantly navigated in its upper part as it is in its lower. The Zemindars were so senseless, that they demanded such enormous duties as to render the navigation more expensive than land carriage. To suppose that the boats which swarm on the Lower Godavery would not go up the river if they could do it profitably, is to suppose what is inconceivable.

In his 39th paragraph Col. Baker says, he is not sanguine about the cheapness and speed of transit on the rivers that I expect, and that the steam-boat department of Government has had the experience of twenty years. To this I say, 1st, have the government tried the effect of spending £10,000 a mile upon the water, as they have upon the land. They almost totally neglect these magnificent navigations, spend upon them either nothing at all or less than the thousandth part of what they are worth, and then say, what miserable navigations they were; and yet even in this neglected state, they carry goods at one-fourth the cost that railways can carry them. 2nd. How invariably this is the excuse for doing nothing, "it has been tried." To suppose that with the comparatively insignificant experience we have had in steam navigation on rivers in India, we have discovered all that can be discovered, is the height of delusion. There is nothing of which I am more certain, from what is now actually done on such unmanageable rivers as the Rhone, &c., than that, even in their present state, the rivers in India may be navigated by steam both much cheaper and much quicker than they are now.

In the 40th paragraph, he speaks of boats going at three miles an hour, that they may not make a ripple injurious to the banks of canals. How strange it is that people continually talk in this way. Because little narrow winding canals, not intended or adapted to steam-power and high speed, and without a foot of land to spare on either side, are liable to injury, therefore, canals must always be injured by high-speed, though they are constructed so as to bear it. Do men argue that the new railways cannot be worked at high-speed because the original tram-roads will not bear it. The banks of canals can be protected from the ripple at an insignificant expense. Even one of the canals in England is actually worked by steam at seven miles an hour, without any protection to the banks, and had about one per cent. been added to its cost at first, it would have borne any speed.

Colonel Baker then estimates the cost of river transit at ⅜ths of a penny per ton; but it is only what he reckons the average at present on the unimproved rivers, and he allows nothing for the change that might be effected in the rivers at a comparatively trifling cost.

I have passed over the paragraphs where Colonel Baker speaks of the proposed improvement of the river navigation by storing water in tanks in the monsoon, and discharging it into them in the dry season. Colonel Baker thinks this worthy of examination, and so far agrees with me; but when he says the great drain on the Jumna and Ganges, to feed the irrigation canals, confers additional interest on any promising scheme of compensation, he by no means places the matter in its true light.

The water proposed to be turned into the Ganges canal, nearly a million cubic yards per hour, is stated to be about half of the total quantity of water in the lower part of the river. Now the abstraction of nearly half the water of a river which is so shallow at places that every inch of depth is of importance, and steamers drawing 3½ feet are constantly getting a-ground, would be utterly ruinous. The great highway of Bengal, the thing upon which the whole present state of things depends, would be essentially obstructed. The reduction of a foot in the depth of the water would not merely stop the present steamers, but would, probably, treble the cost of transit by the native boats, and for five or six months in the year, stop at least ¾ths of the trade. The mischief arising from this would be really incalculable. This is carefully argued in my papers, and surely it was one of the points in which the Governor-General might have expected some distinct conclusions supported by arguments.

Colonel Baker appends to his paper a table of the cost of transit by different means, viz., ocean, river, canal, railway, &c. If my papers had produced no other effect than the further exhibition of such a comparison, I might have been satisfied. Though Colonel Baker has not drawn from it the legitimate conclusions, most assuredly others will.

Take, for instance, such a calculation as this. By this table, the Ganges transit by country boats is, at present, with the river unimproved, about ¼d. per ton per mile, uninsured. But 9/10ths of the goods conveyed are of such small value (from £2 to £8 a ton) that the insurance would be very trifling. By the railway, even the lowest rate is 1d. a ton, after spending £10,000 or £12,000 a mile upon it. The difference calculated on two million tons, carried 600 miles, is no less a sum than four millions sterling a year, the interest of eighty millions. And supposing the river transit were destroyed, and goods had to be carried by rail at 1d. per ton, or four-times the present cost, we may be quite sure that 8/10ths of this traffic would be destroyed.

It is a very great point gained to have the comparative cost of transit brought into broad daylight. Intelligent men will certainly be thus led to consider this question a little more earnestly. Hitherto, universally, railway transit has been spoken of both in England and India as exceedingly cheap, cheaper even than water carriage.

In the United States, the difference of the cost of the two modes is well known, and the effects of it clearly shown. On the Erie canal, a through traffic of about 300,000 tons a month is conveyed, during the seven months that it is open, at a *charge* (not *cost*) of ¼d. per ton per mile; and on the parallel railway the through traffic, during the five months that the canal is closed by frost, is under 10,000 tons a month. The report of the state engineer of New York, for 1853, is full of the most important information on this subject. The following are the *costs* of conveyance by different modes as given in this report:—

Ocean, long voyage	1/15	of a penny.
Lake, do.	⅕ to ⅖	,,
Hudson river	1/7	,,
Erie canal	⅖	,,
Ordinary canals	2/7	,,
Coal railways	⅕ to ⅘	,,
Favourable passenger lines	7/10	,,
Passenger lines with steep gradients	4/7 to 1⅖	,,

This is the actual *cost* of transport without the interest of the cost of the works, which will, of course, be much less on the canals than on the railways, because the former are capable of carrying so much larger quantities. The *charge*, as before stated, is consequently more than three times as great on the Central Railway as on the Erie Canal. And this difference (1¼d. per ton per mile) is sufficient to stop the whole distant traffic, with a trifling exception (only 1/30), for five months in the year, in a country where pretty accurate calculations are made.

In his 42nd paragraph, Col. Baker says, again, that inland water communication will not answer the important purposes of a (high-speed) railway. Does anybody argue that a waggon will answer the purpose of a carriage and four. But if, from this, we jump to the conclusion that, therefore, a farmer ought to *begin* by giving £300 for a carriage, instead of £30 for a waggon, he would certainly leave a considerable gap in his argument.

In conclusion, I beg to call attention to the decisive proof which this Report affords of the complete *misapprehension* of the subject of Public Works for India (and especially of communications) which exists. The Governor-General calls upon his consulting engineer for his opinion upon papers in which the subject is attempted to be discussed, and the Report forwarded in obedience to this order, scarcely touches upon any of the really fundamental points in the question. The results of Colonel Baker's investigation were given in 13 conclusions, *not one of which* affects the real questions at issue—viz., what works, considering the circumstances of India, should be first executed? If everyone of these conclusions were fully granted, they leave us exactly where we were. We have in fact arrived at conclusions before we have begun the discussion.

I remain, yours obediently,
ARTHUR COTTON.

P. S.—With reference to what Colonel Baker says about railways carrying at one farthing a ton a mile, I cannot help quoting a passage from the New York State Engineers' Report for 1853.

"At the Railway Convention held at New York, embracing the officers of the four great lines between the Atlantic and the West, a joint Report was submitted, stating, that 'experience has proved that the lowest rates at which ordinary freight (carried in freight trains at ten or twelve miles an hour, and in large quantities), can be carried to pay interest [on lines costing only £5000 or £6000 a mile] and expenses will average about a penny per ton per mile for heavy agricultural products, three halfpence for groceries, and two-pence for dry goods." At a subsequent Convention of the railway companies of Ohio and Indiana, similar rates were adopted: The above charges applied to the business of one or two great roads, would yield an average of a little less than three halfpence, and would serve to show, *that some of the business done on each of these roads does not even pay interest and expenses.* Sufficient information has been elicited from the railroads of this and other states, from the reports of conventions and other sources, to warrant the belief that a considerable portion of the freighting business now done by our railroads *yields no profit at the present rates*, when due allowance is made for the increase-of capital which it requires for the increased wear and depreciation of the works, and for the occupation of the line to the injury of the other business.

No unbiassed person can read the later reports of the English railways without being satisfied that this is at least as applicable to them as to those of the United States.

The Mail just arrived from India contains the following:—"The Bengal Coal Company have not yet been able, say the Directors, to make any terms with the Railway Company for the conveyance of their coal. They intend, therefore, to trust to the Damooda." That is, after spending £12,000 a mile upon land communication, calling in all the engineering science of the West, and adding the trifling aid of steam power, the railway is actually beat by one of the worst river navigations in India, worked with human labour, and in which not an atom of engineering skill, or one shilling of outlay, has been expended.

TONNAGE REGISTRATION—BRITISH SHIPOWNERS.

Sir,—I have been reading Mr. Atherton's Paper upon "Tonnage Registration," which appears in the *Journal of the Society of Arts* of the 18th of January, as also the discussion upon it, and a letter from that gentleman in a subsequent number of that useful Journal. He does not appear to hold a very exalted opinion of "paragon shipowners" and "heaven-born millionaries." In fact, it is quite impossible that he, or any upright man, can hold a high opinion of even "shipowners, as a class," *if*, as he says, they are merely "honest *as times go*," who, he says, are "certainly not purists," and who, as his letter would all but imply, "go on wrecking *well-insured* ships at the rate of 1,799 ships per annum." The italics are his own. It is ridiculous to suppose, that he could hold an exalted opinion of them. But I think before expressing that opinion in public, he might have adduced some well-founded reasons for it. It is strong, and required a reason. It might not, however, have been convenient for him to give any, or perhaps he was not able to lay his hand upon one for the moment, and for these reasons, I will, for the present at least, deal gently with his unwarrantable, and I may say unfounded remarks, about shipowners as a class. We differ in opinion upon that point, and we part with this hint, that before he again impugns the character of any body of men, he had better produce proof that he is justified in so doing. But there is one point on which we are sure to agree. Shipowners understand their own interests. By the way, Mr. Atherton denies that, for he argues that *he* understands their interests far better than they do. I am sure, however, he will not deny, that they understand what affects their breeches pockets. Is that the great "mystery of their craft?" Well, then, if the "paragon shipowners and heaven-born millionaires are causing the printing-press to overflow with their ecstacy in approbation of the restricted registration prescribed by the Merchant Shipping Law of 1854," and if that law, as he argues, instead of tending to check the enormous losses annually, tends to increase them, how will that affect their breeches pockets? *Not* in the way he seems to suppose. When a ship of mine is wrecked I lose one-half, as I only insure one-half. When Mr. Gilmour loses a ship, his pocket is minus her value, for I believe he never insures at all. At least his late firm did not, and there are many other shipowners who act as we act, and therefore we support the Act of 1854, because we believe that, so far as any Act of Tonnage Registration can affect the safety of shipping, that Act is preferable to any we ever had, or any that was ever propounded. But surely, he cannot think that "even shipowners as a class," are rogues, for such they would be, if they insured their vessels above their value, and did not adopt every precaution to ensure their safety upon the voyage; and he forgets, or perhaps he does not know, that if they acted in the manner he seems to think they do, they would invalidate their policy of insurance; and that if they wilfully lost their vessels, they would be subjected to one of the most severe criminal punishments. He seemed also at the time to forget, if he ever knew, that they were subjected also to very heavy *pecuniary* penalties. Mr. Mitchell (who, to his credit be it said, could not sit in silence and hear shipowners slandered) told him plainly, at the time of the discussion, that they were. These, in his letter, he *partly* enumerates; but he overlooks by far the most important of all; and for that penalty I would refer him to the case of the ship *John*, which was decided only the other day. There he will see one of the very heavy penalties to which shipowners are subjected. He appears also to forget, if he ever knew, or ever thought about it, that it is *not* to the interest of shipowners to have their vessels deeply laden. Their interest is to make their voyages quickly; and that they cannot expect to do if deeply immersed in the water. And he overlooks altogether the important fact that commanders and officers will not sail in ships where their lives would be placed in more than ordinary jeopardy, and that no law can compel them to do so. I reason with him, as you will perceive, upon matters which affect simply the lives, the pockets, and the personal freedom of owners, and masters, and officers of ships, as he unquestionably appears to hold the opinion that they have not a soul to soar above any one of these. On anything loftier connected with them, it would be waste of time for me to argue with one who, while he holds so exalted an opinion of himself, can hardly, by any possibility, hold more than a very ordinary opinion of others.

I make no pretensions to scientific knowledge. Mr. Atherton does. He wanders in its loftiest regions, and it strikes me that he often loses himself in those clouds which keen eyes alone can penetrate. His position gives him the *entrée* to those lofty regions of science, but his production warrants me in thinking that he has been elevated to a sphere for which Nature never intended him. Pray ask him to step down for half-an-hour to Mother Earth and common sense, and forgive me if I cannot talk about parallelograms and parabolas, for my training was in the forecastle of a ship.

Well, then, Mr. Atherton no doubt holds a very comfortable appointment. That being so, I presume he would not give it up till he secured a better. He tells these purse-proud, stupid Shipowners, who he is quite certain "do not sigh for the public good," that the present mode of Tonnage Registration is a very imperfect one. But acting as he would act himself, those Shipowners do not feel at all disposed to give it up, unless he, or someone else, can produce a better. That is quite reasonable, you will admit. Nay more, as it is exactly the same as he would do in any matter where his own interests were concerned, he must allow that it is a very wise course for such a set of very ordinary mortals to follow. But he will also say, he has proposed a better, and that he made known his plans to the Executive, while the Bill of 1854 was in abeyance; but that those who had the framing of the Merchant Shipping Law of that year would not adopt them. I dare say not. No wonder. How could he expect them to have faith in that, the principles of which even now Mr. Atherton knows not how to put into practice? His principle of Admeasurement is based upon displacement—at least, he tells us so; and when Mr. Scott Russell, who I am sure listened with great impartiality to the paper, asked "what his idea was as to the *possibility* of finding a load water-line, and as to the means which appeared to be within reach for determining it," Mr. Atherton seemed sadly puzzled. He said it would be a matter for "serious consultative deliberation." Of course it would; but that is the *basis* of his theory. Till he determines that, all his figures and rules are worse than worthless. Men of the earth cannot build castles in the air; men of the clouds often do, but they vanish with the ideas that created them. They must have a foundation. Let Mr. Atherton give me *his*, and then I may talk to him even more fully about the structure he intends to rear for my benefit as a Shipowner. He says he has one, but he admits it is only in embryo. It may well be so, for I fear it will never get further. He supposes "a ship to have a 30-feet beam;" then he says, "the deep draught water-line might be fixed at a certain proportion of the beam—say a fourth, or a fifth, or a sixth below the main deck." Now, what does this empirical range of from one-fourth to one sixth give in a ship of 36 feet beam, or about 1,000 tons register? It gives a range of no less than three feet; and if, as he acknowledges, the water-line of this ship may be fixed at three feet higher or three feet lower, which in a vessel of 1,000 tons involves no less than 380 tons of dead weight, it surely is nothing short of arrant nonsense to speak of dead weight cargoes being properly arrived at by the means he proposes. To tell the public that he can—as if he held a conjuror's wand—arrive at that which has baffled the inquiries of both practical and scientific men for ages, by a mere call of "Presto," is Quixotic in the extreme.

To the best of my recollection a plan was introduced some few years ago, when Mr. Labouchere was President of the Board of Trade, for a new mode of admeasurement. It, too, was based upon displacement, or rather upon external measurement and the *principles* of displacement;—upon the established principle that a ton of iron displaced a ton of water, and, therefore, 1,000 tons of iron, or any other description of weight, would displace 1,000 tons of that fluid. This was sound and perfect, as far as it went. A bill was introduced; it passed the first reading. No one could discover anything wrong in it, and for any one to attempt to offer any objection, seeing the vast piles of blue books, and "diagrams and sections, and curves of areas," which were printed about it, would have appeared the height of imprudence. So thinks Mr. Andrew Henderson to a great extent still (who, by the way, has got a pet scheme "of his own," which I can hardly call by a clearer name than the roomage-displacement-tonnage plan, for it is a jumble of Mr. Atherton's roomage, and the exploded plan now under notice, and one originating in his own brain about the cube-contents of water, which he, somehow or other, turns into register tonnage, in the shape of very muddy water indeed). It, however, struck a very plain man that merchant ships are not always laden with iron or other dead weight, and that to find out the displacement it would be necessary so to load them, and he had the audacity to ask the very "scientific" gentleman who planned this new mode of measuring ships, the following rule-of-three question. If 100 tons weight of iron displaces 100 tons of water, how many tons of water will 100 tons measurement of hat-boxes, or Manchester bales, or cork, or tea, displace? The "scientific" gentleman could not answer till he had had an opportunity of putting the hats, the bales, the tea, or the cork into scales, and weighing them. He then, for the first time, thought that merchant ships really *did* carry other descriptions of goods besides dead weight. The public never heard anything more of the scheme upon which the bill that passed its first reading had been founded, and before the government ventured to introduce another, they made sure that it was perfectly practicable. Mr. Atherton has given no reason to show that his plan would not meet with a similar fate were any government good-natured enough to introduce a bill upon it.

But I will follow his proposed legal load-line a little further. Suppose, for the sake of argument, that that line has been fixed upon as a mean, for instance, of the above range, and that the ship of 36-feet beam goes to sea, and that she is found to be crank, leewardly, and unmanageable. What would the owner do? He would, from his knowledge of those things, desire to bring her down a few inches. That he could not do, although the legal line might just as well have been fixed according to Mr. Atherton's range, at 18 inches higher. He would be obliged, therefore, to his great injury, to be satisfied with his ship, rendered bad by law, when probably she would prove a superior vessel if no such parliamentary interference existed between him and his property.

Here, then, is a vessel, with a legally-fixed displacement, condemned as a model, whereas, under a different load-line, she might prove a very superior ship. She would be stamped with a false character by Act of Parliament, and this false stamp would form the basis of that inductive science which, according to Mr. Atherton's notions, would so improve the models of our Merchant Navy, that not only our lives would be safer, but the very bread of life itself would be thereby cheapened. How can the Chief Engineer of a Royal Dockyard gravely propound such gross absurdities?

But let me trace his views a little further, for I have not done yet. I may choose, or I may have reason to build a ship of such a depth in relation to the breadth as would bring the proposed legal load-line actually below the keel, and thus my ship, to conform to the law, must be made to sail in *the air!!* Would she not? What would brother Jonathan say to that? He constructed a ship "to lick creation," which was such "a mighty goer," that she never wanted more than "a drop of dew under her bilges"!!! Our American brethren are fond of a joke, and they know it to be one. Mr. Atherton, however, says in all seriousness, that we should make a law which will compel British ships to float in the air!!—to lick the licker of creation by Act of Parliament!!

He further says, the marking of the load-line on "colliers" was enforced by Parliament. This is a grave misrepresentation, which he will find by again referring to "Moorsom's Review of the Laws of Tonnage," from which he has taken the whole of his historical view of the question. He will there see that only *keels* were so nailed and marked; and keels, I may add, are open barges, only employed in loading colliers.

He also says that the load-line of men-of-war is *fixed*. Now, on this matter he ought to be an authority, but even here he is not correct, for they are continually altered by the addition or subtraction of ballast, whenever their sea-going properties show it to be desirable. Thus, the only two authorities he attempts to bring forward in favour of an enforced load-line are misrepresentations, and to enforce such a line by Act of Parliament—a line which even he cannot discover—would, so far from being beneficial, prove most injurious, in my humble opinion, to the science of Naval Architecture, and which I desire to see improved quite as much as any one who ever gave any attention to the subject.

Now, one word, and one word only, as to the proposed "Light Water-line." Mr. Atherton desires to have that fixed, too. It may be easier than to fix a load-line; but, practically, it cannot be obtained. An owner would require to complete his ship for sea, before taking any cargo on board, and after the most complete equipment—with stores even for an 18 months' voyage—many vessels would not stand upon their legs without ballast. How, then, would he meet these difficulties—and would he, by an Act of Parliament, enforce that which was not practicable? And where would be the true Light-line, with ballast on board?

He says that the existing law, as regards its practical operation, cannot be carried out by the practical measurer. I was struck with this statement, and made inquiry at the proper quarter. I find this, too, a mis-statement. Mr. Atherton, and one or two who think with him, say that the dimensions only are taken by the practical officers, and that the calculations are made in London. Now, I learn that the whole tonnage of the vessel is completed by the officer who measures her, and which is sent to London only for examination. I find, further, that the document transmitted for examination is almost invariably returned in course of post, and I cannot learn that one single complaint has been made of detention through this most desirable system of proving the tonnage. I need hardly tell any one conversant with the subject, that the errors existing under the tonnage of the late law, show the *absolute* necessity of a check under any system that might be established. I can excuse him for a fallacy in theory, but not for an error in fact, which he ought to have known before circulating to the extent he has done his scheme of Admeasurement.

But the most triumphant answer I can give to the objections to the existing law on account of the difficulties which it is said to create, is the fact, that though more than 3,000 vessels have been measured by it, vessels scattered over every part of the kingdom, even to the most remote creeks of Ireland and the Highlands of Scotland, no difficulty whatever has been experienced in carrying out the law; and from all I can learn every practical officer states that it is more simple than the late imperfect system, even though more measurements require to be taken. "Paragon shipowners" may well cause "the printing press to overflow with ecstacy in approbation of a law" which, while it leaves them to build those forms of ships best adapted for competition with other nations, checks fraud, aids them in their ocean race for supremacy, and is at the same time so simple that the most illiterate officer of Customs can easily be made to understand its mode of application. If Mr. Atherton can propose anything half so good, he will stand higher in public estimation than he is likely to do after a perusal of his present paper.

But though it is little better than waste of valuable time for me to examine the nature of the structure when he has failed to show any foundation on which it can be reared, I will, as the pen is in my hands, venture a passing remark on the method or rule proposed for calculating "roomage," and dead-weight cargoes. And here let me ask—why change the word tonnage into roomage? Tonnage, as I understand it, applies to both weight and measurement. And the greater the register of a ship by the present mode of Admeasurement, the more she carries (of dead weight) and stows (of light goods). Thus from the present Register Tonnage a calculation can easily be made of what she can carry and stow, far more accurately than any other law or plan I ever heard of. The cube contents of her hold are known. The shipowner contracting for specified dimensions and model, knows exactly what he will obtain; and the merchant chartering —(and this is of far greater importance than Mr. Atherton seems to be aware of)—knows exactly the space he engages, for it is inserted upon the Certificate of Registry, in tons of 100 cubic feet each. No former law gave that most valuable information. The old or Builder's Admeasurement, was so far out that a ship of 20 feet depth, and with a capacity twice as great, registered no more than a ship of 10 feet depth; and, by the subsequent law, the hold of a vessel might be constructed in various ways, without in the slightest degree altering her Register Tonnage.

But to the proposed mode of ascertaining "roomage." Mr. Atherton says that the depth of the ship is to be divided into three parts, one to consist of the hold from below to the light-line—a line, by the way, he has not yet discovered; the other from the light-line to the *load*-line—a line he will never discover; and the remaining part, from the last imaginary line to the upper deck. Then he says, that the cube contents of the lower part is to be found by multiplying the length of light-line—a line he knows not—into its internal breadth, and after that into the depth. This, he says, will give the circumscribing cube, or box of the lower part; and he gets the body of the ship by taking 40-100ths of it. Then he says that the measurer is to *observe* whether the ship is "full or very full, hollow or very hollow," and that *he* is to add or subtract accordingly 5 or 10 per cent. as the case may be. He proposes a similar process for each of the other parts, and these being added together and divided by 40, will give, he says, the roomage or measurement at 40 feet to the ton. Now would these operations not take quite as long as the existing mode, which Mr. Atherton does not deny gives the correct cube contents; and would they be correct? I am sure he must have great doubts of their accuracy, for he knows not, any more than I do, the position of the two lines on which he bases them. But what about the trimming of the model according to the measurer's professional eye, who, likely enough, may be some insolvent butcher, or baker, or broken down village politician, appointed through our precious system of Parliamentary patronage to a berth in the Customs? What kind of regulation would *he* make of the 5 or 10 per cent., more or less, which is proposed to be left entirely in his hands?

Truly Mr. Atherton does advocate a very pretty way indeed of ascertaining the correct tonnage of a great maritime nation, such as England. After all his parade of science, he gravely proposes the most arrogant piece of quackery it has ever been my lot to read. In the very centre of civilization, and in a Journal read by the truly scientific men of every country—and by quacks too, I fear—Mr. Atherton, a Chief Engineer in one of our Royal Dockyards, "nails his colours to the mast," and asks the shipowners of England to adopt and legalise a scheme which has absurdity on the face of it—an absurdity which must be apparent to the most illiterate of the class whom he appears so heartily to despise.

It is indeed a pity that the government cannot keep him better employed than agitating against a plan which they themselves, after mature consideration, have adopted, and which, so far as it has been allowed to progress, has given every satisfaction to the interests who are the best judges of its merits, or for whose benefits it has been established. He must excuse me when I say that, after a careful perusal of his Paper on Tonnage Registration, I must inquire and see what he knows about engineering, for if he propounds similar plans in his own particular department, and is allowed to act upon them, the public purse, of which I am a very humble guardian, may suffer somewhat considerably.

I am, Sir, your obedient servant,
W. S. LINDSAY.

8, Austinfriars.

DECIMAL SYSTEM OF MONEY.

SIR,—I desire to bring this subject before the notice of the Society, from a point of view under which, as I think, it has not been sufficiently considered.

The extent of labour which might be saved by the use of logarithms and other tables, and by the slide rule, if our whole metrical system were decimalised, is obvious; but it is not generally perceived how much would be gained in this way, were our money alone to be decimal. Indeed, it is one of the most frequent arguments against the change proposed in our accounts, that it is useless to adopt a decimal system by halves; and, therefore, why change our money, and leave our weights and measures as they are? This argument can be satisfactorily answered only by a consideration of the actual mode in which tables affect commercial arithmetic.

We have at present, and can have, no universal "Ready Reckoner." With our present system, each tradesman must have separate books for his wholesale and retail business, and each trade requires a different set. These books are sufficiently cumbrous, and still often require several references and additions to get the required result. This, in a great measure, defeats the purpose of the "Ready Reckoner," and it would be almost entirely obviated if the money alone were decimal.

The great difficulty of adapting any sort of tables to our present monetary notation, arises from the fact that, in general, no two multiples of a sum expressed in £ s. d. have the same digits. Thus, neither 10, 12, nor 20 times £2 18s. 5d. are £218 5s., or £21 8s. 5d.; and, if 4 times either of these amounts be given, it does not enable us to see at a glance what 40 times the original amount is. Now, if our money be decimal, to know the value of 4lbs. of beef, is also to know the value of 40lbs., of 400lbs., or of 4,000lbs. Moreover, the price of 27 articles at 3d., does not tell us the price of 27 articles at 3s., or at £3. With decimal money, one entry in our table tells us all these, and the prices of 270, of 2,700, and of 27,000 also. This leads us to such a consolidation of our tabular arithmetic, as would render it available for miscellaneous use—a thing hitherto quite out of the question.

For the decimal accounts, the "Ready Reckoner" would contain a multiplication table up to 100 × 100, judiciously arranged, with auxiliary tables for the sub-divisions required. There are very few purposes which would not be served by two auxiliary tables, one of 16ths (or oz. for lbs.), with ¼oz., ½oz., and ¾oz., and one of 12ths. There might also be a page or two for days in the week, month, and year, and a few similar things, and the "Reckoner" would not then exceed a pamphlet of two sheets 8vo, while it would be far more powerful than most that exist under the present system. One reference would serve common purposes—two references and an addition would serve most. Thus, to find 8,254 at £0·076, we should find, at one opening ·076 × 8200 = 623·2, and ·076 × 54 = 4·104, whence the answer £627·304. To find 97lbs. 6oz. of tea at £0·28 (= 5s. 7¼d. nearly), one opening gives 97 × ·28 = 27·16, and in another we find 6oz. at 0·28 per lb. to be ·105—giving £27·265 at the price required.

For counting-house purposes, a larger book might contain the multiplication table up to 100 × 1,000. This would make a volume of about 250 pages.

The use of LOGARITHMS in most branches of wholesale trade, has been prevented entirely by the want of a decimal system of money. The irregular sub-division of weights and measures would not have kept them out, any more than the sexagesimal division of the circle has kept them out of trigonometry. The main object of all commercial calculation is, to obtain money values, and each trade can well afford to keep and use a table of decimal equivalents for the sub-divisions of its metrical unit. But the money reductions occur so frequently, that it is only complicated work, like that which concerns interest or annuities, in which it is worth while to use decimals under the existing system of accounts.

Mathematical history affords an example of the partial introduction of a decimal system with success, while the attempts at its complete adoption signally failed. In the earlier days of trigonometry, the radius, as well as the arc, was divided sexagesimally. This division dated from the time of Ptolemy, if not of some previous astronomer, and continued long after the introduction of decimal notation in arithmetic. The first step made was to publish a table of sines to the radius 6,000,000; Purbach and Regiomontanus, in 1541, published double tables of sines to the radii of 6,000,000 and 10,000,000. In 1581, Maurice Bressius published tables, in which, not only is the radius made equal to 60°, but the sines themselves are sexagesimally expressed. The decimal division of the radius had, however, been already established by Rheticus, Vieta, and Pitiscus.

The next step was taken by Henry Briggs, the inventor of the common logarithms. He was afraid to venture upon the complete decimal division of the quadrant, but he used the centesimal division of the degree, in the same way as we still subdivide seconds. I do not find that he was followed by any one except John Newton (A.D. 1654, and 1658). From that time until the French Revolution, we find nothing but the decimal division of the radius and the sexagesimal division of the degree.

The French Directory decided that the division of the arc should be made to correspond with the rest of their metrical system. In 1799 and in 1801, very good tables were published in Berlin and Paris for this system, and the finest set of tables ever collected, the Grandes Tables du Cadastre, were computed under the care of Prony. But the thing never took, out of France, and even there it did not flourish. The last set of tables that I can hear of with the decimal division of the quadrant, is Didot's stereotyped table of 1814, to six figures; and in this, there is a table of logarithmic sines and tangents for degrees and sexagesimal minutes. The Tables du Cadastre were never printed, and still remain in MS. in the library of the Paris Observatory.

The mathematician has far more complex calculations than any merchant or banker, and is quite as well aware as any one can be of the advantage of economy in computation. He soon discovered, and held fast to, the advantage of the decimal division of the radius, his great medium of comparison, occupying the same place in his system of accounts, as the £ s. d. entries in the trader's books. He did not consider the advantage of extending his decimal division beyond his medium of reference, equal to the trouble of the change. The failure of the French experiment showed that he was right.

The foregoing considerations and example enable us, as I think, altogether to avoid the offered dilemma of decimalising our whole metrical system, or leaving our standard of value untouched. The former alternative is impossible. The year cannot be decimally divided into days; and even the French Directory did not suggest ten months for a year, or a similar division for the day.

I have the honour to be, Sir,
Your obedient servant,
CHARLES W. MERRIFIELD.

13, Brompton-row, Jan. 28, 1856.

Proceedings of Institutions.

ALTON.—The Museum of the Mechanics' Institution, which was recently opened, contains upwards of 4,000 specimens, including: Zoology—Quadrupeds and Birds, chiefly British, 110; Eggs of British Birds, 430; Shells, 360; British Land and Freshwater Shells, 800; Comparative Anatomy, chiefly Osteology, 250. Botany—A few Specimens. Geology—Local, 900; British, 1,200. Mineralogy—260. Coins, and Local Antiquities—300. Miscellaneous—100. It is open to the members, free, with the privilege of purchasing a Yearly Family Ticket for 2*s*. 6*d*., if Annual Subscribers, or 1*s*. 6*d*. if Quarterly Subscribers. Non-member's Yearly Tickets are 2*s*. 6*d*. each for an individual, and 5*s*. for a family. Single admissions 6*d*. The Working Classes are admitted on Saturday evenings for 2*d*. each. The Committee, being desirous of giving the Museum, as much as possible, an Educational character, have formed a Natural History Class, which meets every Friday evening in the Museum. It is proposed that short but systematic Conversational Lectures should be given, illustrated, as far as possible, by the specimens in the Museum; and that the Members of the Class take every opportunity of bringing specimens to the meetings, and of adding to the contents of the Museum, more especially in the department of Local Natural History. Classes from public schools in the town and neighbouring villages are to be admitted gratuitously. It appears that there is still remaining against the Institution a balance of 45*l*. 4*s*. 6*d*., on account of the purchase and fitting up of the premises.

CAMBERWELL.—On Tuesday, the 5th inst., Mr. C. Charles gave, for the first time, a most amusing lecture to the Literary and Scientific Institution, on "The Ludicrous and Lyrical Literature of Love." The subject was well handled by Mr. Charles, who gave several illustrations, from different authors, of Love in its different phases, both cheerful and lugubrious. The memorable Valentine from Sam Weller to Mary, and the scene from the "Merry Wives of Windsor," describing the ducking of Sir John Falstaff, were received with great favour. Mr. Charles's sketch of an excited Frenchman and a wideawake Yankee, was most amusing, and showed that he possessed great versatility of talent. The Lecture was enlivened with several songs, such as the "Standard Bearer," "Widow Machree," "Love Not," and many others, and gave great satisfaction to a large audience.

CRIEFF.—The winter session of the Mechanics' Institution commenced in November last, and was opened by a very interesting address from the President, Mr. Laurie. On the 14th January, Mr. Sheriff Barclay, LL.D., delivered the first public lecture of the session; the subject was "Matter and Mind," and the learned gentleman discoursed most eloquently and impressively on the vast powers of the human mind, and its amazing and growing triumphs over the material universe, as proving its divine source, and pointing to its glorious destiny in the mysterious future of man's existence. On the 7th January, a musical *soirée* was held in the Freemasons' Hall, under the auspices of this Institution. In their preliminary arrangements, the committee were warmly aided by Sir William Keith Murray, Bart., of Ochtertyre; and through his kind offices they were enabled to enter into an arrangement with the celebrated violincello performer, M. Dreschler, of Edinburgh, and the astonishing young violin performer, Master Carl Rossi, from Germany, who is only twelve and a-half years of age. Sir William was kind enough to take charge of the entertainment, which his knowledge and taste so well qualified him to do. The programme consisted of a judicious selection of some of the finest pieces of music, intermingled with various Scottish melodies. The worthy Baronet condescended to take part in the concert, and his performances on the clarionet were such as few amateurs ever can hope to reach. The piano-forte accompaniments were chiefly executed by Mr. Davidson, of St. Paul's Chapel, Edinburgh, in the most efficient manner; he also performed a fantasia on the harmonium. After the exhibition of various comic illustrations of character and some beautiful chromatropes, by means of a powerful magic lantern, votes of thanks were passed by acclamation to Sir William K. Murray and all concerned in the entertainments of the evening. A very large and respectable audience assembled in the same place, on the evening of the 24th January, to hear William Stirling, Esq., of Keir, (M.P. for the county), deliver his promised lecture on "The Writers on the War." The honorable lecturer criticised a little severely the various explanations given of the objects we have in view in fighting the battles of Turkey against the Russian emperors, and thought that the only intelligible view of the matter was the defence of our Eastern possessions, and that France had a similar motive in the preservation of her noble colony of Algeria. He then gave a rapid and very lucid sketch of the rise and progress of the war, elucidating the subject by reading a number of thrilling details of the leading events of the campaign on the Euxine and Baltic, culled from the writings of many of the authors who have written on the war. The books containing these passages were most liberally presented by the lecturer to the library of the institution. On the motion of the Rev. J. R. Ormond, who very warmly eulogised the talents of the honourable member as an author and lecturer, a very hearty vote of thanks was given to him for his able and interesting lecture. Dr. Fairless (Hon. Secretary) then moved the thanks of the meeting to the Chairman, Thomas Graham Stirling, Esq., of Strowan.

LONDON.—On Thursday evening, the 17th ult., Mr. Alfred Bunn gave his popular American entertainment, entitled "A Visit from John to Jonathan," to the members of the London and South Western Railway Literary and Scientific Institution. The chair was taken by Mr. F. J. Macaulay, the Honorary Secretary. The Lecturer briefly described the famous cities of Boston, New York, and Washington, and ably narrated some amusing incidents attending his visit to those places, and touched generally upon the character, industry, habits, and feelings of their inhabitants. Among the most interesting of the many statistical details of the lecturer, were those connected with the great Falls of Niagara, which Mr. Bunn described and explained in a manner which drew forth repeated plaudits from his numerous hearers. The lecture occupied two and a-half hours in delivery, and excited the greatest interest of a crowded audience.

RADWAY (NEAR BANBURY).—The half-yearly meeting of this Institution was held on Wednesday, the 23rd ult. The chair was occupied by Mr. J. Hoare. The meeting was attended by about forty of the members. This Society, which has now been established three years, has improved much during the past six months. Classes have been formed for teaching writing and arithmetic twice a week during the winter, and have been attended by seventeen pupils. During the last five months, the number of books and periodicals taken out of the library have been, by 55 males, 484; and by 11 females, 78; total, 562; being an average of 8·5 to each person. The number of members is 86. During the last quarter 1,231 persons have attended the reading-room, giving an average of 14 per night.

MEETINGS FOR THE ENSUING WEEK.

MON. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Architects, 8.
Geographical, 8½, 1, "Remarks on the Open Sea in the North Polar Basin." 2. Mr. A. G. Gregory, "Progress of the North Australian Expedition." 3. Mr. James Wilson, "Letter to Sir Roderick J. Murchison on the same." 4. Mr. H. Landor, "Notes on the probable Condition of the Interior of Australia." 5. Report of Surveyor R. Austin, Commanding the Expedition to explore the Interior of Western Australia, N. and E. of the settled districts.
TUES. Royal Inst., 3, Prof. Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½, Dr. Benisch, "On Rabbi Petachia's Travels in Palestine."
Civil Engineers, 8, Renewed Discussion upon Mr. Robinson's Paper, "On the Past and Present Condition of the River Thames."
Med. and Chirurg., 8½.
Zoological, 9.
WED. Literary Fund, 3.
London Inst., 3, Mr. Robert Grant, "On Elementary Astronomy."
Society of Arts, 8, Mr. Henry Chance, "On the Manufacture of Crown and Sheet Glass."
Graphic, 8.
Ethnological, 8½.
Roy. Soc. Literature, 8½.
THURS. Royal Institution, 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.
FRI. Geological, 1, Anniversary.
Royal Institution, 8½, Prof. Huxley, "On Natural History as Knowledge, Discipline, and Power."
SAT. Asiatic, 2.
London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Medical, 8.

To Correspondents.

ERRATUM.—In the account of Major Pratt's patent, N 3,309—1810, of last week, for "a series of ploughs revolve o a horizontal axis"—read, *a series of ploughs revolve horizontally on a vertical axis.*

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered during the Vacation, 1855.

391. Poor Law Union Clerks—Return.
434. County Courts—Return.
502. Officers (Navy)—Returns.
515. Church Convocation (Nova Scotia)—Return.
427 (1). Sale of Beer, &c.—Index to Report, &c.
462. Fines and Penalties (Ireland)—Abstract of Accounts.
482. Income Tax—Return.
483. Poor Relief—Returns.

489. Select Committees—Return.
506. Chicory—Copy of Orders, &c.
509. Chemical Establishment (Excise Department)—Return.
462. Standing Orders.
432. Adulteration of Food, &c.—1st Report.
365. Metropolitan Workhouses, &c.—Returns.
307. County Courts—Return.
477. Metropolis Turnpike Roads—Returns.
484. Private Bills—Return.
506. Spirits (Scotland)—Return.
521. Kensington Gardens, &c.—Return.
525. Convocation—Address.
465. Dividends (Public Funds)—Correspondence.
486. Royal Society—Account.
474. Joint Stock Companies—Report.
487. Public Bills—Alphabetical List.
491. Petitions for Private Bills—Return.
512. Balaklava Harbour—Correspondence.
514. East India (Assistant Surgeons)—Report.
528. Income Tax, &c.—Return.
532. New Churches—35th Report.
65 (7). Trade and Navigation Accounts (31st July).
398. County Treasurers—Abstract of Accounts.
436. Westminster New Palace (Great Clock and Bells)—Papers, &c.
448. Navy, Army, &c. (1853-54)—Detailed Accounts of Receipts and Expenditure.
468. Railways—Return.
488. National Gallery—Minutes of the Trustees.
469. Duchy of Lancaster—Account.
471. Demerara—Correspondence.
472. Statute Law Commission—Replies from Messrs. Anstey and Coode.
473. Steam Vessels—Return.
488. Sittings of the House—Return.
492. Divisions of the House—Return.
485. Civil Bills, &c. (Ireland)—Returns.
486. County Courts (Ireland)—Return.
501. Agricultural Statistics—Lords' Report.
517. Transports—Return.
519. Militia—Return of Regiments Embodied.
523. Bristol Port—Report of the Colonial Land and Emigration Commissioners.
530. Militia—Return of the Strength of each Regiment.
526. Conseils de Prud'hommes (France and Belgium)—Memorandum.
423. East India (Selections from Records of Government)—Return.
445. Postal Arrangements (Waterford, &c.)—Report.
509. Corporate Accounts (Ireland)—Return.
534. Population, &c.—Returns.
524. High Constables—Return.
479. Burial Fees—Returns.
438. Torture (Madras)—Return.
447. Printing (Houses of Parliament, &c.)—Report.
504. Sugar, &c.—Return.
513. East India (Civil Service)—Copy of the Reports.
518. Naval Prizes—Return.
65 (8). Trade and Navigation Accounts (31st August).
530. Public Offices and Civil Service—Papers, and Index to Reports.
366. Finance Accounts—Classes 1 to 8.
421. Stoppage of Wages (Hosiery)—Report from Committee.
496. National Debt—Return.
415. Metropolitan Communications—Report.
470. West India Islands Relief—Correspondence.
489. Adulteration of Food, &c.—Second Report.
358. Woods, Forests, &c.—33d Report of Commissioners.
476. Kingstown Harbour—Copy of Instructions to Mr. Rendel.
478. Tower Hill, &c. Paving—Correspondence.
516. Railways—Returns.
530 (1). Civil Service—Index to Reports, and Papers relating thereto.
481. Public Prosecutors—Report from Committee.
65 (9). Trade and Navigation Accounts (30th September).
415 (1). Metropolitan Communications—Index to Report.
475. Grand Jury Presentments (Ireland)—Abstract of Accounts.
529. Divisions of the House of Commons, 1836-1852—General Index.
490. Business of the House—Return.
494. Income Tax—Return.
507. Tea, &c.—Return.
65 (10). Trade and Navigation Accounts (31st October).
489 (1). Adulteration of Food, &c.—Index to Reports.
443. Municipal Boroughs (England and Wales)—Abstract of Return.
493. Election Auditors—Abstract of Return.
65 (11). Trade and Navigation Accounts (30th November).
485. Private Bills—Returns.
486. Public Petitions—Returns.
533. Fees (Clerks of Assize, &c.)—Abstract of Return.
527. Public Appointments—Return.
531. Public Petitions (1833-1852)—General Index to Reports.
493. Savings Banks—Return.
497. Savings Banks—Return.
452. Public Income and Expenditure—Account.
486 (1). Public Petitions—Abstract of Sums paid for Printing, &c.
505. National Gallery, &c.—Returns.
497. Savings Banks—Returns (a corrected leaf).
318. Army before Sebastopol—Index to Reports.
247. Bills—Colonial Appeals.
267. Bills—Insolvency and Bankruptcy (Scotland) (amended).
268. Bills—Bankruptcy and Insolvency (Ireland).
Public General Acts—Cap. 82 to 134, and Table.
Lunatic Asylums (Ireland)—7th Report.
War with Russia—Further Papers.
South Staffordshire Railway (Collision at Dudley Station)—Further Correspondence.
Trade and Navigation (1841 to 1850)—Tables.
Statistical Tables (Foreign Countries)—Part 2.
Inclosure Commission—Special Report.
Convict Prisons (Pentonville, &c.)—Reports of Directors.
General Board of Health—Report of the Medical Council.
General Board of Health—Report on the Results of the different Methods of Treatment of Cholera (1854).
Military Prisons (1854)—Report by Colonel Jebb.
Australian Colonies (Convict Discipline and Transportation)—Further Correspondence.
Railway Accidents (June)—Reports.
Mining Districts—Report of the Commissioner.
River Tyne—Analytical Index.
Coal Mines—Report of Inspectors (Messrs. Dunn, Dickenson, &c.).
Coasting Trade (Foreign Countries)—Despatches.
Sierra Leone (Prevention of Slave Dealing)—Papers.
Trade of Foreign Countries—Abstract of Reports.
General Board of Health (Cholera Epidemic of 1854)—Appendix to Report.
General Board of Health (Cholera Epidemic of 1854)—Two Diagrams.
Sierra Leone (Moriah Chiefs)—Correspondence.
National Education (Ireland)—21st Report, vol. 1, part 2.
Inns of Court and Inns of Chancery—Report of Commissioners.
Trade and Navigation of the United Kingdom (1854)—Annual Statement.
Railways—Return respecting the number of Passengers, &c. (30th June, 1855).
Turnpike Trusts (England and Wales)—Abstract of General Statements of Income and Expenditure.
Prisons—20th Report of the Inspectors (Southern and Western District), part 3.

Delivered on 1st February, 1856.

Session 1854-5.

503. Colonial Expenditure—General Abstract.

Delivered on 2nd and 4th February, 1856.

Agricultural Statistics (Scotland)—Report.
Agricultural Statistics in Ireland (1854)—Returns.
British Army in the Crimea—Report of the Commission of Inquiry.
British Army in the Crimea—Appendix to the Report.
Disturbances in Hyde-park—Report of Commissioners.
Sweden and Norway—Treaty.
France (Printed Papers by Post)—Convention.
Prussia (International Copyright)—Convention.
Japan (Admission of British Ships)—Convention.
Turkey and Sardinia (Joint Captures)—Convention.
Divisions of Trophies and Booty—Declaration signed at Paris.
Chili—Treaty of Friendship, Commerce, and Navigation.

Delivered on 5th February, 1856.

1. Public Income and Expenditure (Balance Sheet)—Account.
4. Naval Receipt and Expenditure—Account.
1. Bills—Partnership Amendment.
2. Bills—Joint Stock Companies.
Poor Relief (Scotland)—10th Report of the Board of Supervision.
Queen's University in Ireland—Report.

Delivered on 6th February, 1856.

5. General Committee of Elections—Mr. Speaker's Warrant.
7. Bill—Metropolitan Police.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette February 1st*, 1856.]

Dated 14th November, 1855.

2572. Alfred Vincent Newton, 66, Chancery-lane,—Improvements in the construction of locks. (A communication.)

Dated 2nd January, 1856.

8. Andrew Shanks, 6, Robert-street, Adelphi—Improvements in machinery for cutting screws.

Dated 12th January, 1856.

89. Alexander Bain, Westbourne-park-road, Paddington—Improvements in the construction of inkstands.

91. Charles François Leopold Oudry, 39, Rue de l'Echiquier, Paris—Improvements in the preservation of metals and other solid substances.

93. William Owen, Rotherham—Improvements in the manufacture of railway wheels and tyres.

95. Alexander Bankier Freeland, Manchester—Improvements in the preparation of flour for the purposes of its better preservation and carriage, and in the machinery or apparatus employed therein.

Dated 14th January, 1856.

97. William Collett Homersham, Caroline Villas, Kentish Town—Improvements in machinery for the preparation of hemp, flax, and other fibrous materials.

99. Adolf Pollak, Vienna—Treating waste oily matters to obtain a product applicable to the manufacture of soap and other useful purposes in the arts.

101. Nathaniel Shattswell Dodge, 44, Saint Paul's Churchyard—Improvements in the preparation or manufacture of leather cloth.

103. John Gottlieb Ulrich, 62, Mark-lane—Improvements in chronometers and other time-keepers.

105. Abraham Gerard Brade, Paris—Improvements in recovering the wool from fabrics in which the same exists, together with silk or vegetable textile fibres.

Dated 15*th January*, 1856.

107. Pierre Theophile Auguste Nicoulland, 39, Rue de l'Echiquier, Paris—Improvements in steam boiler furnaces. (A communication.)
109. Samuel Sheppard, Birmingham—Improved tap or stop-cock.

Dated 16*th January*, 1856.

113. Henry Law, 15, Essex-street, Strand—Improvements in heaving-up slips for the repair or construction of ships or other vessels, and for a continuous-action purchase for the same which is also applicable to other purposes.
115. Vincent Scully, and Bennett Johns Heywood, Dublin—Improvements in the construction of inkstands, applicable in part to other vessels for the reception of fluids.
117. John Hamilton, junior, Liverpool—Improvements in the posts or uprights employed in constructing electric telegraphs.
119. John Hamilton, junior, Liverpool—Improvements in constructing the permanent ways of railways.
121. David Dring, 149, Great Dover-road—Improvements in machinery for cutting wood pegs. (A communication.)

Dated 17*th January*, 1856.

123. Peter Armand le Comte de Fontainemoreau, 4, South-street, Finsbury—Improved apparatus for the prevention of accidents or collisions on railways. (A communication.)
124. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved gas-meter. (A communication.)
125. Philipp Rechten, Bremen—The taking of whales and other cetaceous fish by means of a harpoon constructed on entire new principles.
127. James Jackson, Manchester—Improved apparatus for retaining and releasing cords of "Venetian blinds," or cords, bands, or chains employed for other purposes.
128. Oliver Philcox, 30, Willes-road, Kentish Town—Increasing the effect and the facility in fingering the pianoforte, organ, or other musical instrument having a keyboard.
129. William Chapman, Sunderland—Improvement in propelling vessels.
130. Joseph Jesse Comstock, New York—Improvements in generating steam. (A communication.)

Dated 18*th January*, 1856.

134. Joseph Moseley, Well Walk, Hampstead—The transport of all goods, merchandise, and valuable commodities whatsoever.
136. Joseph Schloss, Wellington Chambers, Cannon-street West—A piston bolt, or certain improvements in fastening travelling bags, portmonnaies, cigar cases, writing desks, drawers, doors, and similar objects where locks, bolts, or clasps are employed.
138. Henry Griffith Rule, Manchester—Improvements in machinery or apparatus for measuring water or other fluids.
140. Edward Myers, Rotherham—Improvements in buffers and other springs for railway and other carriages.
142. François Jules Manceaux, Paris—Improvements in fire-arms.
144. Charles Weightman Harrison, Woolwich—Improvements in transmitting communications, and in the apparatus employed therein.
146. James Buckley, Oldham—Improvements in looms for weaving.

Dated 19*th January*, 1856.

148. Alfred Dawson, 14, Barnes place, Mile End Road—An apparatus for converting small coals, or coal dust, or small coals and coke, or coal dust and coke, with the admixture of water or other materials, into solid blocks of fuel, parts of which apparatus can be used and are suited for other purposes.
150. John Armour, Kirkton Bleach Works, Renfrew—Improvements in bleaching, washing, or cleansing textile fabrics and materials.
152. Thomas Horsfall, Deptford, and William Turnbull, Rotherhithe—Improved machinery for breaking and preparing hemp, flax, and other similar vegetable fibres.
154. Herman John Van den Hout, and Ebenezer Brown, Kentish Town—Improvements in the preparation of pulp for the manufacture of paper, millboard, and other like purposes.

Dated 21*st January*, 1856.

156. Rev. Samuel Fenton, Saint Mary's, Wavertree, Lancaster—Improvements in locks and fastenings.
158. John Gedge, 4, Wellington-street South, Strand—Improvements in the manufacture of boots or shoes. (A communication.)

Dated 22*nd January*, 1856.

162. Pierre Lewis Tieffé-Lacroix, Metz—Improvements in machinery for cutting files.
164. John Gedge, 4, Wellington-street South, Strand—Improvements in wrought iron wheels. (A communication.)
166. Peter Armand le Comte de Fontainemoreau, 4, South-street, Finsbury—Improvements in machinery or apparatus for manufacturing nails. (A communication.)
168. Thomas Hitt, Tavistock-street—Certain arrangements of machinery for converting reciprocating into rotary motion.
172. John Beech and Edward Jeffreys, Shrewsbury—Improvements in the means of supporting the rails of railways.

Dated 23*rd January*, 1856.

175. John Onions, Wellington-place, Blackfriars-road, Southwark—Improvements in the manufacture of iron.
176. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved manufacture of yarn from wool or other felting material. (A communication.)
180. Johannis Joachim Mathias Meyer, Bartlett's Buildings—Improved mode of manufacturing bank notes, cheques, and other like documents.
182. Archibald Turner, Leicester—Improvements in the manufacture of elastic fabrics.
184. James Newman, Birmingham, and William Whittle, Smethwick—Improvements in the manufacture of shafting for mill and engine purposes, which improvements are also applicable to the manufacture of shafts, poles, beams, masts, spars, and other similar articles, in which great strength or lightness, or both these qualities combined, may be requisite.

WEEKLY LIST OF PATENTS SEALED.

Sealed February 1*st*, 1856.

1741. Samuel Mellor and Thomas Young.
1748. John Stanley.
1750. Samson Woller and Illingworth Butterfield.
1760. Frederick Robert Augustus Glover.
1790. William Mitchell Tillieston.
1795. John Coope Haddan.
1812. George Durham and Cornelius Wyatt.
1818. Philip Latour and Maurice Latour.
1819. Pontus Lagergren.
1845. John Coope Haddan.
1851. John Avery.
1853. John Barber.
1855. Peter Armand le Comte de Fontaine Moreau.
1881. Alexander Bain.
1886. Pierre Gontier.
1888. Robert Longsdon.
1890. George Lewis.
1902. William Pitt and Edward Turner Davies.
1912. William Kidman.
1925. William Brown.
1943. Charles Esplin.
2010. Agostino Palmiéri and Jean Baptiste Ferrari.
2019. James Fraser.
2027. John McIntyre.
2111. James Willis.
2626. Peter Armand le Comte de Fontaine-Moreau.
2632. George Price.
2820. John Henry Johnson.

Sealed February 5*th*, 1856.

1778. Henry Gilbee.
1779. Fischer Alexander Wilson.
1780. John Platt and John Hibbert.
1786. James Alexander Manning.
1797. Philippe Amédée Devy.
1809. Alfred Heaven.
1885. Henry Knighton.
1921. C. Schlickeysen.
1969. John Hope and Thomas Hope.
2227. William Spence.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 28*th*.

230. John Ryall Corry and James Barrett Corry.
241. Jean Baptiste Lavanchy.
251. Louis Guillaume Perreaux.
337. John Perkins.

January 29*th*.

252. Edwin Pugh.
290. Thomas Spiller and Anthony Crowhurst.

January 30*th*.

256. David Chalmers.
258. Frederick Lawrence, William Davidson, and Alfred Lawrence.
273. John Cockerill and Thomas Barnett.
310. Jacob Vale Asbury.

Feburary 1*st*.

299. Alfred Taylor and Henry George Frasi.
302. William Brown.

February 2*nd*.

283. Auguste Edouard Loradoux Bellford.
292. John Heckethorn.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3807	February 1.	Clasp for Belts and other Articles of Dress	Smith, Kemp, and Wright	Birmingham.
3808	February 2.	Lamp for Omnibuses and other Carriages	Price's Patent Candle Company	Belmont, Vauxhall.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 15, 1856.

MEMORANDUM

Respecting the Proposal to Examine and Grant Diplomas to Students of the Classes in Institutions in Union with the Society of Arts.

The subject of promoting classes for systematic instruction in the Institutions associated with this Society has long been under the consideration of the Council of the Society of Arts. In the early part of 1853, the Council appointed a Committee to inquire into the subject of industrial instruction. This Committee obtained a large amount of most valuable evidence on the subject of classes and class examinations, a selection from which was published in an Appendix to the Report of that Committee, issued under the sanction of the Council in June, 1853.*

The subject of examinations, to be followed by certificates, was brought before the Conference of the Representatives of the Associated Institutions, held at the Society's house in the Adelphi, in July, 1854, when it was unanimously resolved:—"That the Conference cordially approve, and request the Council to carry out their proposed system for examining and granting certificates to the students of classes of the Institutions in union with the Society."

In June, 1854, Viscount Ebrington addressed to Mr. H. Chester, at that time chairman of the Council, a letter, urging the importance of organising a system of examination in rural districts; and at the Conference in July, 1854, it was unanimously resolved:—"That the Council be requested to prepare a plan for extending to the inhabitants of rural and other districts, where the establishment of Mechanics' Institutes is difficult or impossible, the benefit of connection with this Society, and of the local examinations proposed to be established by the Society in concert with the local Institutions associated with it."

The subject was again brought under the notice of the Council at the Conference in June last, and at the opening of the current session its importance was pressed on the attention of the Society at large in the address of the Rev. Dr. Booth, the present chairman of the Council.

Notwithstanding the admitted importance of examination as an efficient instrument for the promotion of education, and as the surest test of intellectual capacity and attainment, but few candidates presented themselves for examination. The idea of such a system was novel, and its advantages not immediately apparent. Meanwhile the political exigencies of the country imperatively called for the adoption of that very system which the Council of the Society of Arts had vainly attempted to introduce among its associated Institutions.

Success in competitive examination has very recently become the sole passport to employment in the civil service of the East India Company. Success in examination is also a necessary preliminary to admission into the Royal Artillery and the Royal Engineers, into the Admiralty, into the War Department, into the Privy Council Office, and into the Government departments generally. Examination has been revived in the Inns of Court, and it is in contemplation to incorporate them into a legal university. Now that minute and systematic examination into the natural ability and acquired attainments of candidates for employment in their services which the Crown and the East India Company are enabled efficiently to secure, the Council of the Society of Arts would desire to effect for the Manufacturing and Commercial interests of the country. It is obvious that the valuable employments connected with these bodies will always secure a large supply of well instructed Candidates. Though the Society of Arts cannot hold out equal inducements, yet there can be little doubt, that were the extensive commercial establishments of this country, the great employers of labour, the railway companies, the large manufacturers, and the friends of education, to agree to recognise the results of the examinations conducted under the sanction of the Society of Arts, and set forth in *Certificates* awarded with discretion and integrity, a great boon would be held out to the unfriended talent of the country. The Society of Arts' Certificate would thus be accepted, instead of the vague and worthless testimonials so frequently and so heedlessly given.

It is hoped that few will look coldly upon an attempt to supply to the members of the Literary and Scientific Institutions, Mechanics' Institutes, and Athenæums, in union with the Society of Arts, a portion, however small, of those advantages which are abundantly offered to the higher classes of the community at the Universities in their competitive examinations, honours, and degrees.

To ascertain how far the public may be prepared, practically to co-operate with the Society in the laborious and useful task it has undertaken, the Council invite the adhesion of the friends of education, of the railway companies and other public bodies, of large commercial houses, of engineers, manufacturers, contractors, and other great employers of labour, to the following

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* The Report of the Committee appointed by the Council of the Society of Arts to inquire into the subject of Industrial Instruction, with the evidence on which the Report is founded. Published under the sanction of the Council. Pp. 232, price 5s. Longmans and Co., 1853.

DECLARATION.

We, the undersigned, having considered the memorandum of the Council of the Society of Arts, and the plan therein set forth, for examining and granting certificates to the students of classes for adult instruction in the Literary and Scientific Institutions, Mechanics' Institutes, Athenæums, and other similar bodies in Union with the said Society, do hereby declare that we desire to promote the success of the said plan, and are prepared to regard as *testimonials worthy of credit* such certificates as may be awarded in conformity thereto.

In accordance with the unanimous recommendation of the Meeting of Representatives, held at the Society's house on the 18th of last month, the Council propose to give effect to the views of the Institutions so repeatedly expressed, and to hold examinations at which certificates of merit shall be duly awarded.

The following Rules and Conditions have been made by the Council.

1. That every candidate for examination shall have been for a certain period a regular attendant at a class in an Associated Institution.

2. That the examinations shall be conducted by men of distinguished reputation and superior attainments, so that their awards may justly command the confidence of the public.

3. That the examiners may award certificates of three grades of merit.

4. That first-class certificates be very cautiously awarded, so as to indicate a high degree of solid attainment.

5. That the examinations be held at the Society's house in the Adelphi, during the week commencing the 9th of June, 1856.

6. That candidates who propose to offer themselves for examination, shall give notice of their intention in writing, to the Secretary, on or before Saturday, the 31st of May, 1856.

7. That the ensuing examinations shall comprise the elements of mathematics (including arithmetic), mechanics, physiology, botany, chemistry, political and physical geography, English history, English composition, the Latin, French, and German languages.

8. That every candidate shall be examined in two of the above subjects at least.

9. That the examiners prepare a statement, in which shall be clearly set forth within what limits they will examine in the above subjects, and the text books which they recommend.

N.B.—Candidates will be expected to possess a competent knowledge of writing and spelling.

Mr. **Robert Stephenson**, M.P., F.R.S., President of the Institution of Civil Engineers, and Vice-President of this Society, having given a donation of ten guineas, to be applied to promote the system of examinations which are now being established for candidates from classes at Mechanics' Institutes, the Council have determined to offer it as a "Stephenson Prize," to be awarded to that person who shall pass the most successful examination in Mathematics and Mechanics, and obtain a first-class certificate in each. Mr. C. **Wentworth Dilke**, Vice-President, has offered a prize of ten guineas, to be awarded by the Society's examiners to the candidate who shall pass the best examination in English History.

CLASS BOOKS FOR INSTITUTES.

A deputation from the Council, consisting of Wm. Ewart, Esq., M.P., the Rev. Dr. Booth, F.R.S., Chairman of the Council, Col. Sykes, F.R.S., Mr. G. F. Wilson, F.R.S., Mr. Winkworth, and Mr. Le Neve Foster, M.A., secretary, had an interview yesterday afternoon with the Lord-President of the Privy Council, on the subject of extending to Mechanics' Institutes, and other Institutions in Union with the Society of Arts, the privileges in regard to the purchase of books and apparatus now enjoyed by schools under inspection.

The deputation were most favourably received, and his lordship stated that the subject should have his best consideration.

SURPLUS FROM PATENT OFFICE FEES.

The Council of the Society of Arts, acquiescing in the objects of the letter of Sir Joseph Paxton, published in No. 167 of this Journal, appointed a very large and influential Committee of inventors and others to consider and report upon the subjects therein referred to. The first meeting of this Committee took place last Friday, when there were present, among others, Lord Stanley, M.P., Sir Joseph Paxton, M.P., (who was called to the chair, on the motion of Dr. Booth, F.R.S., chairman of Council,) Messrs. W. Bridges Adams, I. G. Appold, F.R.S., T. Aston, J. M. Blashfield, I. Braithwaite, Dugald Campbell, E. Chadwick, C.B., R. L. Chance, Henry Cole, C.B., Dr. J. H. Gilbert, Peter Graham, A. C. Hobbs, Owen Jones, Charles May, F.R.S., I. J. Mechi, T. Webster, F.R.S., E. Woods, and C. Wordsworth.

It appeared to be the unanimous opinion of the meeting that the first thing to be done was to obtain the recognition by the Government of the principle that the revenue arising from patent fees should not go into the general revenue of the country, but should be applied specially for the promotion of the progress of invention. It was shown that this very point was advanced by the Committee of the Society which obtained the Patent Law Amendment Act of 1852, and that one of the heads of a bill prepared by that Committee was:—"18. That the surplus profits, after paying office expenses and compensations, should be directly applied to some public purpose connected with invention, but not be carried to the consolidated fund." In speaking of the surplus, it should be understood that under the existing system all fees taken at the Patent Office are collected in the form of stamps, and thus go directly into the general revenue of the country. The expenses of the Patent Office are included in the estimates voted annually by Parliament, and on the magnitude of this vote does the power of the Patent Office for good depend. The Amendment Act of 1852 was never looked upon as a final measure. It was remarked by Mr. Webster, that it was all that could be obtained at the time,—not all that was wanted,—and whilst we were thankful for what was done then, we would now begin again. When once the principle was recognised by the Government, that the surplus arising from Patent Office fees should not form part of the general revenue of the country, then would come the inquiry, as to how best it might be disposed of. It was agreed on all hands to be desirable that all specifications, including those for the last 200 years, should be printed and published at a low rate; and that they should be properly arranged and classified. It was only by such means that we could arrive at a knowledge of what had been proposed, and hope to avoid some of the loss of labour of re-invention. It was absolutely necessary for the progress of invention that what had been done in the past should be known. Thus it has lately been ascertained, that about 150 years ago, a patent was taken out for a revolver, and one had also been granted many years back for a reaping machine. These ideas, now proved to be sound and good, failed to be carried out at the moment, owing probably to the then imperfect state of mechanical science. The world was not ripe for them; but it was desirable that they should be preserved where they would be easily accessible and could be constantly seen, so that the ideas might never be lost. Mr. Chadwick mentioned that it had recently come to his knowledge that the same invention had been patented no less than fourteen times. He had no doubt that every one of the fourteen individuals had absolutely re-invented the article in total ignorance that anything of the kind before existed. Mr. May, on this point said that an endless band-saw, which was shown in the French Exhibition, and was said to be a French invention, had been patented in England so far back as 1808; also, that the same mechanical arrangements precisely had been re-patented in 1837, and again in 1846. If easily accessible, and proper records had existed, this could hardly have happened.

In regard to the question of models, it was thought not to be to the advantage of the public to follow the American plan of requiring a model to be deposited of every invention capable of being so illustrated. The American Model Gallery is little better than a lumber-room. Besides, many things of questionable value are patented, and the models in most cases would be rude, and behind the time. Again, many patents are taken out for improvements in details of mechanism; these could not be faithfully exhibited by a model or specimen of the part so improved—the whole machine would be necessary. It seemed to be agreed that models, to a limited extent, might be useful. On this point, Mr. Webster said that there were often prepared, at great expense, for use in the Law Courts—and, he feared, there must always be litigation in regard to patents—historical series of models of some particular invention. Now, if instead of permitting these to be dispersed, as at present, and probably, after a time, broken up, they were all collected at the Patent Office, a complete history of the progress of successful inventions would be obtained. What was wanted was the leading types of successful inventions, those which marked eras in industrial progress, from which new industries arose, or which gave to old ones a new development. Mr. Charles May said that everyone engaged, either in taking out patents, in managing patents, or in giving evidence in patent cases in courts of law, must be thoroughly convinced that a radical change was wanted. He hoped that the law would be amended *ab initio*. The present form of obtaining patents by petition to the Commissioners, who neither by time nor education could possibly understand anything of the merits of the application, was absurd, and the fees to the Attorney and Solicitor generals for doing "worse than nothing," were little less so. Mr. T. R. Crampton thought the present scale of fees too high. It was higher than in any other country except the United States. From practical experience, he had found no difficulty with low fees, and in France the arrangements were so simple that it was a pleasure to take out a patent there. Mr. A. C. Hobbs would, on another occasion, enter into the question of what privileges the patent law should confer. At present it gave a man no right, but only the power to sue. Mr. Webster thought that the wholesome working of the present system of repeated payments—that is, £25 for three years, £50 at the end of the third year, and £100 at the end of the seventh year—was shown in the fact that about two-thirds of the patents dropped after the third year. Thus obstructive patents were cleared off, but still they would be recorded and published for the benefit of others. The unwearied and indefatigable exertions of Mr. Bennet Woodcroft, Superintendent of Patents, were highly commended, and the increased facilities and improvements which had taken place within the last few years were mainly to be attributed to that gentleman, with whom the task was considered to be a "labour of love;" and it was thought that if Mr. Woodcroft were allowed full scope, there would be little to complain of.

The following resolutions were passed unanimously:—

Moved by Lord Stanley, M.P., seconded by Mr. Henry Cole, C.B., and

Resolved,—That this Committee concur unanimously in the importance of saving the surplus from absorption in the general public revenue, and that a deputation of patentees and others seek an early interview with the Prime Minister for that purpose.

Moved by Mr. Charles May, F.R.S., seconded by Capt. L. L. Boscawen Ibbetson, F.R.S., and

Resolved,—That it is highly desirable to place the Patent Office upon a footing correspondent with the permanent industrial position of the country, and that steps be taken to press upon the Commissioners of Patents, upon the Government and the legislature, the propriety of having the surplus arising from patent fees appropriated to that object.

Moved by Mr. A. C. Hobbs, seconded by Mr. R. L. Chance, and

Resolved,—That a report founded on the foregoing resolutions be addressed to the Council of the Society of Arts, inviting the Council to exert all its influence in obtaining the practical realisation of the objects therein proposed.

Moved by Mr. T. R. Crampton, seconded by Mr. Dugald Campbell, and

Resolved,—That a Sub-Committee be appointed to consider the present scale of fees and the details requisite to be carried out for placing the Patent Office on a footing of efficiency worthy of the nation.

Moved by Mr. T. Webster, F.R.S., seconded by Lord Stanley, M.P., and

Resolved,—That the thanks of the meeting be given to Sir Joseph Paxton, M.P., for his letter, and that he be requested to continue his exertions in behalf of inventors and the advancement of practical science.

DECIMAL COINAGE COMMISSION.

It is understood that the Commissioners have appointed Archibald Smith, Esq., of the Chancery bar, and George Shaw Lefevre, Esq., of the Middle Temple, Joint Secretaries to the Commission. It is said that meetings of the Commission were held on Wednesday and Saturday in last week.

NINTH ORDINARY MEETING.

Wednesday, February 13, 1856.

The Ninth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 13th instant, Apsley Pellatt, Esq., M.P., in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Fisher, John.
Fletcher, Robert
Johnston, James, jun.
Longbottom, Abram.
Mitchell, William.

The paper read was

ON THE MANUFACTURE OF CROWN AND SHEET GLASS.

By Henry Chance, M.A.

The admirable manner in which the curiosities of one great division of the glass manufacture, that of flint glass, have been recorded by an able chronicler,* induces me to confine myself to another and scarcely less interesting branch, the manufacture of blown window glass. The history of this glass is most scanty, when compared with the abundant proofs which Egypt, Greece, and Rome, have left behind, of their daily use of vessels and ornaments of glass, and of the skill of those who fashioned them. The general silence of the ancient writers, and the lack of all allusions to the subject, are sufficiently convincing of their ignorance: and, even in the first century of the Christian era, the words of Seneca and Philo might bear a doubtful meaning, but for the evidence of an unimpeachable witness. Pompeii, awakened from a slumber of seventeen hundred years, has proved the existence of window glass in the days of the early emperors. In a small chamber, attached to the bathing-room of a private dwelling-house, excavated about the year 1763, was found, "a window, closed by a moveable frame of wood, which, though converted into charcoal, still held, when it was found, four panes of glass about six inches square." And, in 1824, in a room connected with the public baths, was discovered "a window, two feet six inches high, and three feet wide, in the bronze frame of which were found set four very beautiful panes of glass, fastened by small nuts and screws, very ingeniously contrived, with a view to being able to remove the glass at pleasure." But this disclosure goes no further than to prove the then existence of such glass, and does not interfere with our belief that windows of that age were generally glazed with mica stone, or lapis specularis, obtained chiefly from Cyprus, Spain, and Cappadocia. In the fourth century, Lactantius and St. Jerome allude to window glass, and we hear of glass in churches and public buildings, but then, and long after, in these only. Nearly three centuries later, in 674, the Abbot Benedict, so saith the venerable Bede, sent for artists from beyond seas to glaze the church and monastery of Wearmouth, and York Cathedral was glazed about the same time. In the eleventh and twelfth centuries, glass was generally employed in the windows of the numerous religious edifices which the pious enthusiasm of that period called into existence; but the specimens handed down to us fall so far short of the products of to-day, that we can scarcely believe, what is undoubtedly the fact, that the two are results of processes substantially the same.

White glass, for house windows, was not introduced into England until the close of the twelfth century; but, even as late as the sixteenth century, it had not entirely displaced the imperfect method of transmitting light through oiled paper, linen cloths, and wooden lattices. In the minutes of a survey of Alnwick Castle, made in 1578, the following curious entry occurs:—"And because, throwe extream windes, the glasses of the windowes of this and other my lords castels and houses, here in the country, dooth decay and waste yt were good the whole leightes of everie windowe, at the departure of his lordshippe from lyinge at anie of his sade castels and houses, and dowring the time of his lordshippes absence, or others lyinge in them, were taken downe and lade up in safetie, and at sooch tyme as other his lordshippe or anie other sholde lye at any of the sade places, the same might then be set uppe of newe with smale charges to his lordshippe; whereas now the decave thereof shall be verie costlie and chargeable to be repayred."

Glass was, probably, not applied to the windows of English farm-houses before the reign of James I. It is mentioned, in 1615, in a lease in the parish of Suffolk, but as late as 1661 in Scotland, "the windows of the ordinary country houses were not glazed, and only the upper parts of those of even the king's palace had glass, the lower ones having two wooden shutters, to open at pleasure and admit fresh air.

These scanty supplies were chiefly imported from abroad. The manufacture of blown window glass in England existed in the fifteenth century, and, perhaps, even prior to that period; but the glass then produced was of a very inferior description, and the first works of note established in this country, were those of Sir Matthew White Ridley and Co., on the river Tyne, at Newcastle, about the middle of the seventeenth century.

Crown and sheet glass are classed among the simple varieties, and are a compound of silica, soda, and lime, the result of the union of silicic acid with two separate bases. Let us regard, for a moment, each of these silicates apart. Silica and soda may be combined by water or by fire, either by the addition of silicic acid to a boiling solution of caustic alkali, or by mixing the two in a dry state and exposing them to the action of heat. In either case the resulting silicate is soluble, more or less so, according to the greater or less proportion of alkali, but still always soluble. The usefulness of this solubility has, of late years, been much developed. In 1844, Mr. Ransome patented the employment of this glass in the manufacture of artificial stone, by mixing it, when dissolved and evaporated to the consistence of a gum, with sand, limestone, and other substances. And quite recently, Mr. Gossage has substituted it for alkali in the manufacture of soap. Its application to the rendering wood uninflammable is of much older date. But for window panes, it is of course quite useless. Nor is the simple silicate of lime more practicable. It is the result only of the most intense heat, and assumes the form more of a slag than a glass. But the union of these two silicates produces a hard, cheap, and transparent material, not indeed absolutely insoluble, but capable of resisting the action of water for a very long period.

The principle ingredient of this trio is silica—which, already distinguished, as the chief element of the bricks with which we build our houses, is now no less distinguished as the chief element of the glass by which we furnish them with light.

The manufacturer employs silica in the shape of sand, selecting such as the microscope and analysis show to be most suitable for his purpose. Every country in which glass is manufactured abounds in this material. The finest English sands are from Alum Bay, in the Isle of Wight, and Lynn, on the coast of Norfolk. The French obtain a very superior sand from the Forest of Fontainebleau, in the neighbourhood of Paris, and to the purity of this and their other materials, the superior colour of their glass may be partially ascribed.

The next important element is soda, which is preferred for this kind of glass, as a cheaper ingredient, to potash. As the use of soda, in its present form, is a comparatively recent introduction, I was anxious to obtain information as to the steps which led to so important an improvement; and I have to thank M. Bontemps for a valuable communication on the subject. Not more than thirty years have elapsed since crown and sheet glass were manufactured from crude alkali obtained from the ashes of a certain sea-weed, and in this country known by the name of kelp. The preparation of kelp for this purpose employed a large population on the northern shores of Scotland and west of Ireland, and the abandonment of this material plunged whole districts into idleness and misery. This kelp was used in combination simply with sand—the kelp containing soda and potash, and furnishing the lime necessary for the composition of the glass. But the glass thus produced was of very variable character, arising from the uncertain quality of the kelp, and also of a very inferior colour, evidence of which is still to be found in the old windows of ancient houses, that have escaped the ravages of improvement.

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* See Mr. Apsley Pellatt's "Curiosities of Glass-Making,"

A similar crude alkali was employed in other countries, under the name of barilla, soda of Alicant, etc., and at Venice, and in the South of France, this was mixed with a natural product called the natron of Egypt, and containing carbonate, sulphate, and muriate of soda.

The discovery of Le Blanc, in 1792, which effected the conversion of common salt into carbonate of soda, was the commencement of a new epoch in the history of this glass. The manufacturers of soap at Marseilles ceased to import the soda of Alicant, and employed this new alkali in its place. Their example was followed by the manufactures of plate glass, and before long, the employment of the old crude alkali was discontinued also in the preparation of blown window glass, and an improved quality and colour was the result.

The alkali thus substituted was the carbonate of soda of commerce, containing, besides carbonate, a considerable portion of undecomposed sulphate. The further improvement which followed, viz., the substitution of simple sulphate of soda for this carbonate of commerce, was due to the researches of the celebrated Gehlen; but some time elapsed before his ideas were carried out in Germany, and it was not until 1825 that the manufacturers of France, released, through the exertions of M. Clement Desormes, from the absurd veto which the government had pronounced on the sale of sulphate of soda, were enabled to turn their attention to the employment of this cheaper article. They proceeded with caution in the introduction of this new ingredient, first mixing a small quantity of sulphate of soda with a large proportion of carbonate, then half of each, and finally, excluding carbonate, they adopted the sole use of sulphate, to the injury doubtless of the colour of their glass, but gainers by the employment of a cheaper and more manageable material. Where colour, however, is an object, as in the manufacture of plate glass, the exclusive use of carbonate of soda is still retained.

The introduction of carbonate of soda, prepared from salt, into the glass manufacture of England, dates from the year 1831. Proceeding cautiously in the steps of their foreign brethren, the English glass makers, after they had established the use of carbonate, made trial of the effect of a small quantity of sulphate of soda in a large quantity of carbonate. The carbonate gradually decreased, until at length, in the preparation of blown window glass, sulphate stood alone. But here, as abroad, the manufacturers of plate glass still adhere to the carbonate.

As the use, whether of carbonate or sulphate of soda, involves their preparation from common salt and sulphuric acid, attempts have been made to accomplish the direct union of silica and salt, in the manufacture of window glass, but have hitherto failed of success. The black bottles of Newcastle are made from common rock salt and sand from the bed of the river, with the carbonate of lime of the soap works, and the tank waste of the alkali makers, but for all better kinds of glass, the circuitous combination of silica and alkali is still found necessary.

The third element in the composition of this glass is lime, which may be introduced as lime, chalk, or limestone. This renders, as I have stated, the alkaline silicate insoluble, and when rightly balanced by the other ingredients, promotes the fusion of the whole, and improves the quality, but when added in excess, the glass becomes hard and difficult to work, and subject to devitrification.

The three sources, then, from which we obtain silica, soda, and lime, the three great elements of window glass, are sand, salt, and chalk or limestone, and of these nature has provided an exhaustless supply.

But besides these, several other ingredients, in much smaller quantities, enter into the composition of this glass. Alumina is sometimes purposely introduced, and is always accidentally present, brought there by the action of the materials upon the clay of the pots in which they are melted. Alumina, if present in any quantity, is always an undesirable element, as, by increasing the number of silicates, it renders the glass more liable to devitrification, it being well known that the more compound a glass is, the more does it display this tendency. Bottle glass, which contains a greater variety of bases than any other, is of all the most easily devitrified.

Another and an unwelcome element is iron, which is almost always present in the sand, sulphate of soda, and chalk, partly in the state of protoxide, the colouring effect of which is partially destroyed by the introduction of manganese, the peroxide of manganese, and the protoxide of iron, each possessing colouring properties, but by their mutual action rendering each other comparatively harmless. The effect of manganese is, however, much interfered with by the carbon, which is necessarily introduced to decompose the sulphate of soda. This carbon, subtracting oxygen from the manganese, prevents its action on the iron.

A little arsenic promotes the decomposition of the other ingredients, and tends to dissipate carbonaceous impurities not otherwise disposed of, but, in excess, it produces a milkiness in the glass, which time will increase.

Lastly, to this farrago of sand, soda, chalk, charcoal, arsenic, and manganese, we add what is abundantly produced in every manufactory of glass, a quantity of waste glass, or cullet, which, being more fusible than the raw materials, facilitates the melting.

The ingredients are mixed in much the same proportions either for crown or sheet glass, with the exception of the lime, of which the nature of the crown glass manipulation requires a smaller quantity.

To lay down any standard proportions is almost impossible, as no two manufacturers use the same, and even in the same works the melting powers of the furnaces may so far differ as to render necessary, for the production of the same glass, variations in the proportions of its elements.

The ingredients, having been thoroughly incorporated together, are, without further preparation, introduced into the pots in which they are to be melted. During the period to which I have referred, when barilla, kelp, and other forms of crude alkali were in use, it was the custom to subject the materials to the preliminary operation of "fritting," or stirring them together under the heat of a reverberatory furnace, thereby effecting partial decomposition, and burning off any carbonaceous inpurities, but the introduction of alkali prepared from salt has removed the necessity of this treatment.

The pots are made of the best Stourbridge clay, mixed with about one-fifth of ground potsherds, and are distinguished from flint glass pots by their greater size, and by the absence of any hood or cover to protect their contents from the fire. Their size has been of late years considerably increased, both in width and height, and a pot whose dimensions would, a few years since, have excited wonder, is now in ordinary use.

These pots are made entirely by hand, no machinery having as yet been invented that can replace that process, slow but sure, by which, bit by bit, the pot is built up. A good pot-maker, with two assistants, can furnish three or four per week. After a careful drying of many months, they are made ready for the furnace by a previous heating in a kiln or pot arch. Here a small lump of coal, thrown against its side, tests the soundness of the pot. If, when struck, it rings well, its future is promising; but if it returns a dull sound, it will, probably be short-lived in the furnace, though now and then such a pot will disappoint the bad opinions formed of it, and turn out a respectable pot after all.

The terrible task of setting these pots in the furnace falls upon the glass-house crew, and the nicety with which these enormous vessels are adjusted in their place, in the teeth of a consuming fire, is, perhaps, that operation which in the many marvels of glass-making would most astonish a stranger to such scenes.

The average duration of the pots when thus fixed is about seven weeks. Some attain the age of ten or twelve, while others, as every manufacturer well knows, terminate their existence prematurely, either from the naturally defective constitution of the pot, or from bad treatment in the pot arch, or more frequently from its having been "starved," exposed, that is, to a current of cold air, in the furnace, through the neglect of the attendant. "Misfortunes never come singly," is an adage applicable to the catastrophes of pots. It was truly remarked to a manufacturer, at a period when such calamaties were frequent, "Your pots break, because they break."

The breakage of a pot often disturbs the furnace to such an extent, that the breakage of others frequently follows, and many weeks will sometimes elapse before the disorganisation thus produced can be rectified. The loss of the pot and the "metal" contained, is nothing as compared with the injury which the glass in the surviving pots, and these pots themselves, are apt to sustain.

My limits compel me to forego any description of the furnace in which the pots are placed, or of the process by which the materials are transformed from their primary condition into a molten vitreous mass. Assuming, then, that our pots are full of melted glass, let us take a brief survey of the two methods by which this glass may be brought into the required form.

Crown glass, as the older of the two in this country, must first claim our attention. Upon the surface of the melted glass is a ring of fire-clay, which, when the materials were thrown in, lay at the bottom of the pot, and after the completion of the melting found its way upwards. This ring is of great service, for, floating in the centre of the pot, it prevents the exterior surface of the metal, or melted glass, which becomes stiff and stringy during the long period of working, from mingling with the interior or hotter surface, which thus remains throughout of a suitable consistency. The labour also of the skimmer, whose duty it is to clear the surface of the metal from any scum or dirt that may collect upon it, is considerably diminished by the ring, which, limiting the space from which the glass is drawn, limits also the space which it is necessary to cleanse, and any bubbles or impurities in the glass have a tendency to attach themselves to the ring.

The metal, or melted glass, having been brought by the gradual cooling of the furnace from a state of complete fluidity to a consistence capable of being worked, the gatherer dips the end of his pipe, or hollow rod of iron, into the pot inside the ring, and twirling it round its axis to equalise the thickness of the gathering, he collects upon the end, or nose, as it is technically called, a pear-shaped lump of glass. Resting his pipe upon a stand or horse he turns it gently round, and allows the surface of the lump to cool, to fit it for a second gathering. The lump completed, the gatherer having cooled his pipe under a trough of water, that he may handle it at any point, proceeds to roll the glass upon a marver, or metallic bed, until it assumes a conical form, the apex of the cone forming the "bullion point." A boy now blows down the pipe while it is still being turned by the gatherer on the marver, and expands the glass into a small globe. Having been heated it is blown again, and assumes the shape of a Florence flask, and the future rim of the developed plate is prepared by rolling the piece, near the pipe nose, upon the edge of a marver. Again heated, it is now expanded by the blower into a large globe. During this expansion, it is important to keep the bullion point exactly in the position which it previously occupied, in a line with the axis of the pipe. To effect this, the blower rests his pipe upon an iron support, and while he blows down the pipe and turns it round at the same time, a boy holds against the bullion point a piece of iron terminating in a small cup. Again presented to the fire, by the peculiar manipulation of the workman and the peculiar direction of the flame upon it, the front of the globe is flattened, the possibility of the globe collapsing during this operation being prevented by its rapid revolution round its axis. The piece now resembles somewhat in shape an enormous decanter, with a very flat bottom and a very short neck. The bullion point is still to be seen in the centre of the flat bottom, and its use now becomes manifest. The pipe is laid horizontally upon an iron rest, and a man approaches having in his hand a large rod of iron called a ponty, tipped with a lump of molten glass. Pressing this lump upon an iron point, so as to give it the form of a little cup, he fits it, when thus shaped, on to the bullion point, to which it soon becomes firmly attached. The lump thus formed is called the bull's eye, or bullion of the developed plate. The incision of a piece of cold iron in the glass round the nose of the pipe, and a smart blow, soon detaches the pipe, which here takes leave of the piece, and after having lain idle a few minutes, till the glass adhering to it has cracked off, it is warmed, and carried back to the pot to repeat its course.

The end of the piece, which was next the now detached pipe, is called the nose, and gives its name to the furnace or nosehole where this nose is, on account of its thickness, heated almost to melting, with a view to the coming operation. The glass now undergoes its last and most dreadful torture in the hands of a man who, with a veil before his face, stands in front of a huge circle of flame, into which he thrusts his piece, rapidly meanwhile revolving his ponty. The action of heat and centrifugal force combined is soon visible. The nose of the piece expands, the parts round cannot resist the tendency—the opening grows larger and larger—for a moment is caught a glimpse of a circle with a double rim; the next moment, before the eyes of the astonished spectator, is whirling a thin transparent circular plate of glass, which, but a few minutes before, was lying in the glass-pot, an undistinguishable portion of the molten mass. Still whirling, the table, as it is now called, is carried off, laid flat upon a support called a whimsey, detached by shears from the ponty, lifted into the annealing kiln upon a fork, and piled upon its edge against the preceding table. The weight of so many tables pressing one against another would cause the hindermost to bend, but this is prevented by the intervention of iron frames or drossers, which divide the tables into sets, the first drosser leaning against the wall of the kiln, the second against the first and so on, and thus rendering each set of tables independent of those behind it for support. As the bull's eye or centre lump, which the ponty has left behind it, keeps each table from close contact with its neighbours, the air passes freely between them, and the annealing is accomplished with tolerable rapidity, varying from twenty-four to forty-eight hours, according to the number of tables in the kiln. From the kiln the tables are conveyed to the warehouse, having passed, since their first exit from the pot, through the hands of ten distinct workmen.

The above brief and vague description of a marvellous process will, I trust, be intelligible to those who have themselves seen it; to those who have not seen it, no description, however elaborate, no diagrams, however clear, can convey any idea of the perpetual change of form, size, and appearance which the glass exhibits during its growth.

The process may be regarded as twofold—first, the development of the lump into a sphere, and, secondly, the resolution of a sphere into a circular table. Constant rotation of the glass, while in a yielding state, is an essential element of this process, as if allowed to remain motionless, its symmetry would be immediately destroyed.

A table of crown-glass of to-day, would scarcely recognise as of kindred origin a table of the earlier part of the present century. The principle of the process in each case was the same; it is the improvement of minute details that produces so different a result. To Mr. Hartley and Mr. Chance, who, during the years 1832 to 1836, gave to the manufacture of this glass their constant attention, is owing, in a great measure, its present status.

When the tables of crown-glass are drawn from the kiln, they are covered with a whitish film or "hum." The history of this "hum" is curious. It arose probably, in the first instance, from the deposition of sulphur from the fuel upon the surface of the glass. It thus became associated with the process of annealing, and buyers fancied that the more "hum" there was upon the glass, the better was the glass annealed. The manufacturers of crown-glass, ever ready to accommodate themselves to the fancies of their customers, have taken the trouble to produce an additional "hum" by the introduction of sulphur in the kiln. The members, however, of the Glass Jury of the Paris Exhibition, not being in the secret of this hum, stoutly maintained that glass thus clouded must be bad glass, and that the hum was owing to the exudation of the alkali.

In the warehouse, the tables are laid upon a "nest," or cushion, and are divided by the diamond of the splitter into two unequal parts,—the larger half containing the "bull's-eye." The diameter of the table is measured on the nest, the usual size being now about 54 inches, and weighing 13 lbs. Tables have been made as wide as 70 inches, but the difficulty of manipulation, and the uncertainty of the result, render such sizes too costly to be general.

The splitter carefully examines each table before splitting it, and turns it round till he has brought it into the position in which he may split it to the best advantage, announcing at the same time its quality. The first quality is called "best"—*rara avis in terris*—the next, seconds—then thirds—fourths—CC—CCC or Irish—and tables containing any very glaring defects, come under the denomination of "coarse."

These variations in quality depend on the presence or absence, number, and extent of those defects to which, even in the best regulated manufactories, glass is unavoidably liable. Perhaps the glass has been badly melted, and is seedy, full, (that is) of little vesicles, to which the rotary motion has given a circular shape. Or the gatherer may have enclosed air within his "metal," and a gatherer's blister is the result—or a pipe blister, or pipe-scales, or dust from the pipe-nose, or dust from the marver, or dust from the bottoming-hole, or dust from the nose-hole, or dust from the flashing-furnace, or bad bullions, or scratches, or music lines, may disfigure the table, or the glass may be crizzled, or curved, or bent, or hard, or smoky, or small and light, defects to explain which, would be a long and dreary task. No wonder that tables of the best quality are few and far between, in some manufactories a forlorn hope never to be realized.

The difficulty of obtaining glass free from defects will account for what may at first astonish,—the fact that the value of a table of the highest quality is three times that of the lowest.

The defects enumerated, many as they are, are instantly detected, even through the obscuring hum, by the splitter, who not only can descry faults invisible to ordinary eyes, but can refer each fault to a particular stage of the process, and to a particular cause in that particular stage, and the faults are registered accordingly. The nomenclature of defects is much facilitated by the mapping out of the table into certain ideal divisions, derived from shapes assumed during various periods of the process. The centre lump is termed the bullion; round this lies the bottom; next the bulge; the shoulder; the top, and the rim, or the outermost edge of the circle.

Independently, however, of these defects, there are certain other disadvantages under which even a faultless table of crown-glass must unavoidably labour. The cutting of a circle into rectangular sheets, must necessarily be attended with waste, while the bull's-eye confines those sheets to comparatively small sizes. Uniformity of thickness, also, except by the most skilful manipulation, is difficult of attainment. Wavy lines, termed music lines, forming a series of concentric circles round the bull's-eye, and owing to the treatment of the glass upon the marver, were formerly a common defect; but improvements in the process have in a great measure removed them.

On the other hand, extreme brilliancy of surface is a distinguishing characteristic of this glass, ascribed by some to the influence of the marver, by others to the effect of the flashing-furnace.

It is this brilliancy of surface which has enabled crown glass to maintain in England its position against that formidable rival of which I must now briefly speak.

Imagine, as before, a lump of glass collected upon the end of the gatherer's pipe. For the metallic table or marver is now substituted a block of wood, so hollowed out as to allow the lump, when placed upon it, to be expanded by the blower to the diameter ultimately required. The block, during this operation, is sprinkled with water, to prevent the wood from being burnt, and from scratching the glass. From the block it is carried to the blowing furnace, which is accessible through a number of holes or openings, each hole been allotted to a single blower. In front of the furnace corresponding to each opening, is a stage or frame of wood, erected over a large pit or well about ten-feet deep, and these parallel stages are sufficiently apart to enable each blower to swing his pipe to and fro in a vertical plane, that the glass may run freely out, as the phrase is, to the required length. When the glass has been sufficiently heated in the blowing furnace, it is brought out, and swung round in a vertical plane, and also backwards and forwards, and the blower, at the same time, by blowing down the pipe, constantly keeps the lengthening cylinder full of air.

Uniformity of substance and of diameter is chiefly secured by the skill of the workman, who, when he finds the metal running out too freely, holds the cylinder vertically above his head, still keeping it well filled with air. These operations are continued until the cylinder has reached the length required. The diameter of the cylinder was determined by the wooden block, and remains the same throughout.

The next stage of the process is opening the end of the cylinder. The thinner kinds of glass are all opened by submitting the end of the cylinder to the fire, and at the same time forcing in air through the pipe and stopping up its aperture. The air is expanded by the heat of the fire, and bursts open the cylinder at the end, this being the hottest and most yielding part. The aperture thus made is widened out to the diameter of the cylinder, by subsequently turning the cylinder to and fro with the opening downwards.

The thicker kinds are opened by attaching a lump of hot glass to the end of the cylinder, which thus becomes the hottest and weakest part, and the air forced in by the blower as before bursts it open. The opening is then enlarged by cutting round it with scissors. If opened in the furnace, as in the first case, the ends of the thicker cylinders would be so thinned out that a considerable portion would be wasted.

The cylinder is now laid on a wooden rest, or "chevalet," and is easily detached from the pipe by the application of a piece of cold iron or steel to the neck of the glass near the pipe-nose; the neck being hot suddenly contracts externally and breaks away from the cylinder. There still remains the cap or end of the cylinder, which is easily taken off by wrapping round the end of the cylinder a thread of hot glass, removing the thread and applying a piece of cold iron to any point which the thread covered.

On the Continent, the operation of heating the glass cylinder is performed in the apertures of the melting furnace; but the obvious advantage of a separate furnace has induced, I believe, one French manufacturer to adopt the English plan, and others will, probably follow his example.

The cylinder, as it now lies upon the chevalet, is little more in weight than two-thirds of the lump of glass which the gatherer collected on his pipe. The quantity left upon the pipe nose, with that which formed the cap of the cylinder, are nearly equivalent in weight to one half the cylinder.

The finished cylinder is now split open by a diamond, which, attached to a long handle, and guided by a wooden rule, is drawn along the inside length of the cylinder, and should pass through or in the neighbourhood of some notable defect or group of defects, if such be present, for defects thus brought to the edges of the subsequent plate of glass are of lessened injury to its value. An object to be avoided is the black mark which the cylinder sometimes receives from the charring of the wooden "chevalet," on which, while hot, it rested in the glass-house. If the diamond passes, inside the cylinder, over the space occupied by this mark upon the outside, the cylinder will fly to pieces. The reason of this is not difficult to understand. The chevalet prevented, by its non-conducting tendency, that portion of the glass with which it was in contact, from cooling equably with the rest, and the particles at that point remained in a state of tension. A careful blower will never place any large defect in his cylinder in contact with the chevalet, being aware of the probable result.

The use of the diamond in dividing plain surfaces of glass, dates from the sixteenth century; but its application to the splitting of cylinders which had not undergone the process of annealing, was introduced not more than twenty years ago, by M. Claudet. Previously, all such cylinders were split by a red-hot iron, and, even now, all cylinders of flashed glass, that is, of ordinary sheet glass covered inside with a skin of coloured, are still split in the same fashion.

On the Continent, I believe, the diamond is gradually replacing the use of red-hot iron, though the latter is still the method more generally practised.

The cylinder is now ready for the flattener, who, having prepared it by a preliminary warming in the flue, by which it is introduced into his furnace, passes it, by means of a croppie, or iron instrument, on to the flattening stone, from the slight irregularities of whose surface it is protected by a lagre, or sheet of glass, laid upon the stone. Upon this lagre the cylinder, lying with the split uppermost, is soon opened by the flame passing over it, and falls back into a wavy sheet. The flattener now applies another instrument, a polissoir, or rod of iron, furnished at the end with a block of wood, and rubs down the waviness into a flat surface, often, upon a refractory piece, using considerable force. Some cylinders are so distorted in the blowing, that no rubbing can flatten them, but all, good, bad, and indifferent, pass through the same treatment. The flattening stone is now moved on wheels to a cooler portion of the furnace, and by the aid of the flattening fork, delivers its sheet to another stone, called the cooling stone. From this, when sufficiently stiff, it is again lifted, and then piled generally on its edge, in order to be annealed.

Very different, both in process and result, was the manufacture of spread, or German cylinder glass, which preceded the introduction into England of the French system. The cylinder, unskilfully blown, was cut open while hot with a pair of shears, and spread out immediately upon a plate of iron, covered with sand. The thickness of this glass was very irregular, and its surface very coarse.

To return to our flattened sheets. The sheets, when annealed, are drawn from the kiln and carried to the warehouse, where they undergo examination.

Sheet glass, blown by a less complex process than crown, is liable in the glass-house to a less number of defects, but the after process of flattening often makes up the deficiency; and the manner in which a sheet, spared by one process, is disfigured by another, is sometimes curiously provoking. Standing before the table of the "assorter," your eye lights upon a piece which, blown under an evil star, has imbibed in the glass-house every possible defect. The founder, skimmer, gatherer, and blower, have all stamped their brand upon it. It is seedy,—the vesicles, which were in the crown tables rounded by the rotary motion of the piece, here elongated by the extension of the cylinder; it is stony, disfigured with stony droppings from the furnace; stringy, thin threads of glass meandering over its surface; "ambitty," covered with stony speckles, symptoms of incipient devitrification; conspicuous with gatherers' blisters and blisters from the pipe—badly gathered; badly blown—thin here, thick there, and grooved with a row of scratches; and on this abortion the flattener chances to have exerted his most exquisite skill; it has passed through his hands unscathed, flat as a polished mirror, yet, from its previous defects, entirely worthless. Next comes before you a piece whose beginning was miraculous,—no seed, no blisters; it prospered under the hands of the gatherer and blower, and left the glass-house a perfect cylinder. But the croppie of the flattener marked it; the fire scalded it; dust fell upon the lagre, and dirtied it; scraps from the edges of the preceding cylinder stayed upon the lagre, and stuck to it; the stone scratched it; and the heat of the annealing chamber bent it. Such are the difficulties to which every cylinder is subject—those of the glass-house, and those of the flattening-kiln. Not all, however, are such as these,—there are good as well as bad, but the good are generally in the minority.

The qualities range thus—best, seconds, thirds, fourths, and H, the latter standing for horticultural, and including all coarse glass, such as may be applied to horticultural purposes. The difficulty of escape from defects renders the best quality, as in crown-glass, three times as costly as the common. The expense of production to the manufacturer is in each case the same; the materials, the labour, the fuel, the same for each. Success, therefore clearly hinges on the proportion of good glass which a manufacturer can obtain. The six qualities of sheet-glass may each consist of six different thicknesses, forming thus, in all, thirty-six varieties.

When this manufacture was new in England, the size usually blown was 36 inches long, and 20 wide. The usual size now is 47 inches long by 32 wide, and cylinders are occasionally blown 77 inches long, but large sizes and heavy weights are accomplished only by workmen of the first class. A sheet of this latter size, containing twenty-one ounces to the foot, would require for its formation a lump of glass upon the gatherer's pipe, of no less than 38 lbs. weight.

The size which sheet-glass can thus reach, is obviously a great advantage, and adapts it to many purposes from which the limited dimensions of crown are excluded. It was this glass that covered the Great Exhibition in 1851. A cylinder was blown to cut, as the phrase is, 49 inches by 30; this was sub-divided into three panes of 49 inches by ten. About 300,000 of these, extending over a million square feet, and weighing upwards of 400 tons, were the work of a few weeks, and this without absorbing or disturbing the ordinary produce of the manufacturer. The energy of the glaziers was equal to their task; 18,392 panes were fixed in the roof in one week, by 80 men, 108 panes being accomplished by one man in a single day.

But sheet-glass has its faults as well as its virtues; it is devoid of that brilliancy of surface for which crown is so remarkable. It is subject, also, to undulations on the surface, the precise origin of which it is difficult to explain. Mr. Shaw, in his admirable lecture on the glass manufacture, as illustrated by the Great Exhibition, speaking of this defect, says, "When the divided cylinder is softened by heat, and either allowed to flatten by its own weight, or flattened by the workmen, the concave interior of the cylinder has to expand, and the convex exterior to contract, as the curved surface becomes plane. Were this contraction and expansion to take place uniformly throughout the glass, the undulation in question would not occur, but since one part invariably yields somewhat more readily than another, perfect flatness cannot be attained."

It is, however, more probable that this undulation is produced in the operation of blowing, and is due to the double movement of the particles of glass which accompanies the formation of every cylinder, the one movement being parallel to the axis of the cylinder, and the other in planes at right angles to that axis.

Having thus briefly described the two distinct processes which converge in one result, a sheet of window glass, I shall now notice the circumstances under which these two processes have attained their present position, and I shall here avail myself of the valuable information which M. Bontemps has provided.

We have no evidence whatever by which to determine the relative antiquity of these two processes. The cylindrical process is the only one mentioned by Theophilus in the 13th century, and this method was adopted by the Venetians, as the more uniform thickness which resulted from it insured, in their coloured glasses, a greater uniformity of colour. But in France, England, and the North of Germany, the cylindrical process fell gradually into disuse, as the demand for coloured glass diminished, and at length in these countries the rotary principle exclusively prevailed, but it was so imperfectly carried out, that the tables seldom exceeded thirty inches in diameter, and were of very variable thickness.

Bohemia, however, still retained the cylindrical process which she had learnt from Venice, and with such success that when the French were in need of large and good glass they imported it from Bohemia.

Thus it was until the commencement of the eighteenth century. Then a French officer, M. Drolenvaux, formed the project of introducing the Bohemian method into France. He constructed a company, brought workmen from Bohemia, and establishd a manufactory at Lettenbach, in 1730, with great success.

From this resulted in France, Belgium, and the North of Holland, where the style of building required panes of large size, the abandonment of the rotary principle and the adoption of the cylindrical, and towards the close of the last century a manufactory near Abbeville, in Normandy, one in Hanover, and two others near Bamberg and Aschaffenburgh, were the last in which the rotary method was employed.

The last of these, that near Aschaffenburgh, was visited by a glass manufacturer, in 1844, and he was much surprised at the very slow and unsystematic manner of proceeding which prevailed there. The gatherers held in their mouths a piece of pasteboard, turned up so as to protect their faces. The nose of the glass, after it had left the pipe and was attached to the ponty, was helped open with a piece of wood, and, after the table had been formed, it was laid upon a bed of small coal or coke and the ponty detached. The table was then piled in the annealing kiln.

In England, the manufacture of crown glass maintained its position, notwithstanding its abandonment abroad, and attained to such superiority over the spread or broad glass, to the rudeness of which I have alluded, that the former was used for all houses of the better class, while the latter was confined to poorer dwellings.

The inferiority of this spread glass, manufactured on the German principle, but by no means so good as the German glass, tended to prejudice the public against all glass manufactured on the cylindrical principle. This prejudice was, however, gradually overcome by the establishment in England of the manufacture of cylindrical glass, according to the process which I have already detailed, introduced from France, and from which resulted a glass which entirely displaced the manufacture of spread glass.

The introduction of this new manufacture was due to Mr. Chance and Mr. Hartley, who, on visiting, in 1830, the works of M. Bontemps, near Paris, were much struck with the advantages of the glass made on this principle, and, having secured the co-operation of M. Bontemps, they commenced the process at their own works in the autumn of 1832. So great, however, were the difficulties to be overcome, that it was not till 1838 that the manufacture of this glass was completely established. Since that time there has been great progress; and the sheet glass now manufactured in this country, though inferior in colour, is in other points generally superior to that of the foreign teachers.

A further development of the sheet glass manufacture in England, was the process of grinding and polishing this glass by machinery, whereby a new branch of manufacture was established, which has furnished glass peculiarly applicable for purposes for which none previously existed.

A fitting companion for this, though not within the limits of blown window glass, is the remarkable invention of Mr. Hartley, by which glass, conveyed directly from the glass pot to a table, is rolled into sheets without employing in each operation more glass than is wanted for each plate of glass, however small it may be. This glass is admirably adapted for those purposes in which translucency only is required.

The greatest stimulus, however, that has been given to the crown and sheet glass manufacture was, the abolition of the duty in 1845. That abolition has produced a somewhat paradoxical result. While the quantity of glass made has increased in the proportion of three to one, the number of manufacturing firms has diminished in the proportion of one to two. In 1844 there were fourteen companies engaged in the manufacture. In 1846 and 1847, following the repeal of the duty, the number had increased to twenty-four. The glass trade, after the removal of the heavy burden imposed upon it, seemed to offer a fair opening for money seeking investment. The demand for glass was so great that the manufacturers were in despair. Glass-houses sprang up like mushrooms. Joint-stock companies were established to satisfy the universal craving for window panes. And what was the result? Of the four-and-twenty companies existing in the year 1847, there were left, in 1854, but ten. At this time there are but seven in the whole United Kingdom. Two, established in Ireland, have ceased to exist. In Scotland, the Dumbarton Works, once famous, were closed, in 1831, by the death of the partners, afterwards reopened, and again closed. The seven now existing are all English.

I turn, in conclusion, from this somewhat melancholy picture to a more cheering subject, the great ends which, from small beginnings, this manufacture has accomplished. The glazier of Pompeii little dreamt that the time would come when the substance that he handled, then so rare, would minister through the world to the health and pleasure of mankind; that beneath it trees would flourish, transported from a foreign soil; and that, cheaper than wood itself, it would combine with iron to form the largest building on the earth. But from Pompeii to the Crystal Palace there has been a progress of nearly twenty centuries, and a still greater progress in action than in time. That progress has been marked by no sudden revolutions, such as have distinguished the development of other efforts of mankind. The problem of blowing glass into a sheet admits of limited solutions, a cylinder or a sphere. Through one or other of these forms the first blown sheet cannot but have passed, and through one or other all pass now. But the progress has been none the less for lack of revolutionising discoveries. Minute and apparently unimportant changes, perceptible only to those near at hand, have in silence done their work.

Still, the development both of its processes and its applications is incomplete. Sir Joseph Paxton's glass arcade, stretching over the streets of London, and Dr. Sleigh's city of glass, in which invalids will inhale the gentle air of Madeira,—these are faint foreshadowings of the destiny of this wonderful substance.

And, perhaps, the day may come when some future chronicler of glass shall smile at the barbarians of the nineteenth century, who could not make window glass without defects, and shall exhibit those defects as the curiosities of a byegone age.

DISCUSSION.

The **Chairman** said, all who had heard the paper read would agree that there was a vivacity in its style which must have rendered it pleasing even to those who did not comprehend the subject on which it treated, while, on the other hand, those conversant with the subject would give the writer credit for the talent which he had displayed. As there were many gentlemen in the room fully conversant with the manufacture in all its details, he hoped they would favour the meeting with a few remarks.

Mr. **Wilson** was sorry that the chairman had called on him to make some observations on the paper just read, before any one else, because he was connected only with the plate-glass making, not the crown and sheet. He would observe, however, that as the paper mentioned that the "trade" fancied that the glass was better finished or annealed if it had a scum or film on it, which the makers called by the appropriate name of "hum," and that a little sulphur was thrown into the annealing oven to give that appearance, so the public should take care that they were not taken in by first appearances. Mr. Wilson did not agree that the French plate glass was superior, or that the Fontainebleau sand was the cause of its greater brilliancy of colour. He had no hesitation in saying that if glass could be made "white," without the use of materials which destroyed its brilliancy, and in other respects spoiled the glass, it would be the perfect colour. But the French glass had a dead, leaden appearance and a dampness on it, which latter he attributed to an excess of alkali, tending to devitrification. Proof of this might be seen if glasses were kept together for any length of time. They were then scarcely to be separated, owing to the damp which exuded. In the United States the effect of climate had also an action on glass, proving further that such was the fact. There was no doubt that the glass made with the common sulphate of soda was as bad as plate glass, from its green colour; but the attempt to reduce the pale blue was attended with extraordinary effects. Mr. Wilson produced a sample of plate glass, originally white, showing that where exposed (part had been covered by ornamental wood work) it had changed to purple. This was from the use of manganese. Another specimen had changed to a gold colour. Referring to the notice taken of the cockle or wavy appearance of the sheet glass, Mr. Wilson attributed it to the contraction and expansion of the metal in cooling. The cast plate glass, before being ground and polished, although a roller of immense weight passed over it whilst in the molten state, showed, on the table side, a roughness, which he attributed to that cause, and on the upper or roller side, presented just the appearance referred to in the sheet glass. Mr. Wilson concluded by regretting that, although the repeal of the duty had caused such improvement and extension of demand, yet it had required such a concentration of capital that the number of manufacturers had been reduced, as mentioned in Mr. Chance's paper.

Mr. W. A. **Swinburne** said, as one of the unfortunate seven manufacturers alluded to in the paper just read, and being connected with the oldest house in the trade, he should like to make a few remarks. After bearing testimony to the general correctness of Mr. H. Chance's communication, and regretting the cause of his absence, Mr. Swinburne stated, with respect to kelp, that he had been one of the first to endeavour to substitute a factitious material, in the manufacture of crown glass, for this very rude and uncertain natural product. By analysing kelp, and using its component parts, he had at last introduced the use of artificial substitutes for kelp. He also mentioned the patent of Mr. Attwood for using the kelp ash, and rejecting the soluble parts, as a step towards the use of a better material. With respect to the "hum," commented on by Mr. Wilson, he did not believe it was at all a necessary symptom of good glass, and he never heard of sulphur being used as described by Mr. H. Chance; at all events he had never so used it himself. As to the superior brilliancy of crown glass, he did not believe that it was produced by the marver, but by the simple effect of heat. He thought this surface, or "skin," as it was technically termed, was simply the fire polish that all glass assumes when exposed to strong heat, and not afterwards affected by any disturbing cause. He begged to supply an omission in the paper just read, which the modesty of the writer possibly prevented his doing. It was the house of Chance and Company which had executed the large order for the 1851 Exhibition without materially affecting their power of executing their general orders, a feat unparalleled in the history of the manufactures of this country, and which, as a rival manufacturer, he had much pleasure in mentioning. There was one article which Mr. Chance had omitted to notice, and which he considered came under the head of "blown window glass," and that was blown plate glass. Perhaps it was not generally known, that originally, all plate glass was made in this country by the process of blowing, and that it was not till 1773 that the British Plate Glass Company first began to make plate glass by casting. Mr. Swinburne described the process as being very similar in principle to that of sheet glass, only differing in some mechanical contrivances to assist the workmen in handling so much heavier a piece of glass. He then alluded to the different price of glass in former times, as compared with the present, speaking of 3s. 6d. or 4s. a foot as having been paid to glaziers now living for glazing ordinary size crown glass in sashes, for which now, perhaps, only as many pence could be obtained. In the case of plate glass, he held in his hand a tariff used by their house, dated 1771, two years before the establishment of the British Plate Glass Company, wherein the price of a chimney mirror 50 inches long by 40 inches wide, a very usual size, and now in common demand, was quoted at £61 3s.! The price of this plate before the repeal of the duty in 1845, was from £9 9s. to £10; after the repeal of the duty, about £8; a year ago, £4 10s.; and now, he was sorry to say, about £4 4s. So much had the public benefited by the reduction of the price of glass.

Mr. F. **Pellatt** proceeded to remark upon two points in the paper, which he described as the most interesting and important to the glassmaker, viz., colour and annealing. He described all glass as being tinted by some colour, either from the presence of impurities in the materials, or the result of deoxidation of the materials (were they chemically pure) in melting. The impurity present in most glass was iron, in the state of the protoxide, which imparted a green colour. To neutralise this the oxide of manganese was used, the effect being to change the green to a brownish yellow colour. This was not obtained by the pink colour of the manganese being antagonistic to the green, and thus subduing it, but by the iron taking another charge of oxygen from the manganese, and so becoming the peroxide of iron, the colour of which was a reddish yellow, whilst the protoxide was green. He was of opinion that all colour was due to the presence of oxygen or carbon in combination with that metallic base of the glass having the greatest affinity for either of these. The reason of manganese being used to de-colour glass was, that it was a metallic base, having the strongest affinity for oxygen, giving it off but very slowly to other bases, and that, during the process of the glass founding, it prevented carbonisation by gradually supplying oxygen. That the colour of the oxide of manganese was due to the oxygen, was readily proved, by thrusting a green stick into a pot of glass made with manganese, the colour of which was purple. The purple would shortly disappear, and a green would take its place, solely from the abstraction of oxygen. Changes in the colour of glass, from exposure to light or heat, might be accounted for upon the same principle. In alluding to annealing he explained that, in cooling, glass contracted, following the law of all other substances, and as bodies in expanding absorbed caloric, so glass in cooling parted with latent caloric, and in so doing a more minute arrangement of atoms took place. The object of annealing was to keep the surface of the glass in the same atomic condition as the interior, allowing a gradual and slow arrangement of atoms during the evolution of the caloric. Though not quite connected with the subject under discussion, Mr. F. Pellatt would ask the permission of the meeting that he might explain how a roller and a cylinder of glass, turned and bored perfectly true, which were exhibited, were produced. They were made under Chedgey's patent, the glass being poured direct from the pot into the moulds. When cylinders were required, the core, which was of iron, was hollow, and the glass was prevented from sticking to the core by a stream of water passing through it while the casting was being made. Thus, pipes for the conveyance of water, acids, and other fluids which act upon metal, might be readily and cheaply made. It might easily be understood what an advantage glass rollers would be in the manufacture of paper, or wherever the machinery was exposed to acids or damp; besides which, a surface was given to fabrics by glass, which the finest polished metal could not produce. It was expected that these rollers and cylinders might be produced at a very moderate cost, and be made of glass of such hardness as to equal the finest steel.

Mr. CLAUDET, F.R.S., begged permission to read the following notes, which he had prepared on the subject under discussion:—

"We are all much indebted to Mr. H. Chance for his valuable, clear, and well-written paper on the manufacture of the various kinds of window glass, one of the most useful and beautiful productions of human industry. Really, when we consider that our dwelling-houses are partly made of that material which protects us from the inclemency of the season, without stopping a ray of the light that renders them cheerful and comfortable, it is difficult to understand how men in our climate could have lived and been happy in ages when glass was unknown. The fact is, without glass, civilisation could never, in northern latitudes, have attained the state of perfection which we enjoy. How could science, art, and manufacture, have flourished in these countries if our houses had been deprived of glass; therefore, we may say, that glass is one of the causes of the progress of mankind.

"Mr. H. Chance has truly observed that the development, both of its processes and its applications, is incomplete, adding, that future ages may smile at the barbarians of the 19th century who could not make window glass without defects. I think that future ages will have more reason to smile at the barbarians who, having the means of obtaining so easily such perfect glass, at so low a cost, used it so sparingly. A time will come when every house, without the least additional expense, nay, with a great saving in its construction, will be supplied with a conservatory on its roof, where children and invalids, in cold and damp weather, will enjoy the genial effects of light in the midst of plants and flowers, from whence we may see the first and the last rays of the sun during the short days of the year.

"Having begun my career as a glass manufacturer, and my lot being to finish it as a photographer, I have been connected with two arts singularly similar in various points, in both of which one might equally find full employment for all the resources of one's mind and activity, and the difficulties of which seem of the same uncertain character, for, as Mr. H. Chance observes, with the greatest skill, care, and attention, the manufacturer of glass is never sure of success; so it is in photography. The reason of this is, that both arts are dependent on so many physical and chemical causes, that it is impossible to foresee, with the least certainty, the result of the action of a variety of elements,—in glass making under the influence of heat, and in photography under the influence of light.

"There is another observation to make as regards the connexion of glass and photography—viz., that without glass there would have been no photography, and that photography is repaying, and will repay still more its gratitude by increasing the consumption of glass. Photographers, for practising their art, are building glass rooms upon the roofs of the best houses in every town, and this will show how easily every house can have its own conservatory.

"The paper we have just heard with so much interest, has a great deficiency, which, in fairness, I am bound to notice. Mr. H. Chance has been just in mentioning many persons who have contributed to the improvements of glass manufacture, but I am sorry he has omitted one who fully deserves to have his merit brought before this meeting. Mr. H. Chance would have deprived us of the knowledge of one of the most important facts connected with the improvements of the manufactory of Messrs. Chance, if I had not taken upon myself to fill the deficiency, which I do with the greatest pleasure, satisfied that the meeting will be happy to know that the improvement I allude to is the work of Mr. James Chance, the brother of the author of this paper. Let us give credit to Mr. H. Chance for his modesty, but let us give credit to the merit of his brother, and I hope my friendly criticism will find an excuse.

"Mr. H. Chance has too briefly noticed that a further development of the sheet glass manufacture in England, was the process of grinding and polishing this glass by machinery, whereby a new branch of manufacture was established, which has furnished glass peculiarly applicable for purposes for which none previously existed.

"This is, indeed, one of the greatest improvements which has ever been introduced in the manufacture of window glass, as it has produced, at a cheap price, an article equal in effect to plate glass, by which all houses can be glazed with a glass which, from the inside, does not distort the objects we look at, and which, from the outside, has the polish and appearance of plate glass.

"To explain all the merits of the invention I must be permitted to expound, in a few words, the process and the difficulties which were to be overcome in the manufacture.

"As Mr. H. Chance has justly remarked, the sheet glass, by the mode of its production, has the polish of its surface spoiled in some degree, but its greatest defect is, that the inside and outside surfaces of the cylinder, not being of the same length, after being developed by the flattening operation, they cannot be in juxta-position on two parallel planes without being forced either one to contract or the other to expand; but as the glass remains too hard during the flattening process to change its molecular arrangement, one surface contracts the other, and the result is a kind of undulating or wavy appearance, called cockles. These cockles reflect and refract light in various and contrary directions, and the objects seen through the glass are thereby distorted.

"Several attempts have been made in France and Germany to grind and polish this glass, in order to destroy these inequalities and imperfections. For this purpose sheet glass had to be made considerably thicker, owing to its never being perfectly flat throughout its length and width, so that one corner or another, and even several points on the surface, were exposed to be completely worn out before the end of the operation.

"Mr. James Chance conceived the ingenious idea of laying every sheet of glass intended to be ground and polished upon a flat surface, covered with a damp piece of soft leather. The sheet adhering completely to the leather after having been pressed against it, producing, in truth, a vacuum, maintaining the whole sheet in a flat position. Two sheets having been placed in this manner, each on the retaining or sucking surface, they are turned one against the other in a horizontal position, sand and water being constantly supplied between them, and by means of the most ingenious machinery, the two surfaces rapidly rub one against the other in all directions, and are ground at the same time by the sand. The whole system of machinery, occupying an immense area in the manufactory, is the invention of Mr. James Chance alone.

"When the grinding has been performed on one surface, the sheets are turned to have the other surface ground in the same manner.

"The sheet being ground while it is kept perfectly flat, it is not necessary to wear out more than a thin layer of the whole surface. Of course, after the operation, the sheet by its own elasticity resumes its former shape more or less curved, but the whole surface of both sides have a polish as perfect as plate glass, and this is the desired condition for glazing purposes. Although the glass could not make perfect mirrors of a large size, on account of the slight curve arising from the flattening operation, still it may be usefully employed for looking glasses of small size. This glass has all the perfection and qualities required for taking pictures by the collodion process, and for framing all photographic and other pictures, for which last purpose it is even preferable to cast plate glass, on account of its lightness.

"Mr. James Chance's invention is therefore, as I said before, one of the most important improvements in the manufacture of window-glass during this century, and to him we owe the cheap kind of glass used in glazing ordinary dwelling-houses, and which is equal in effect to the expensive plate-glass, which was seen before only in the windows of palaces and of aristocratic mansions. We may say that, since the introduction of that glass, London has assumed a more cheerful and luxurious appearance, and that a time will arrive when all houses will be supplied with a kind of glass through which it will be possible to look without fatigue to the eyes, for there is nothing so unpleasant as to see objects distorted in all sorts of ways, as it is with the best crown and sheet glass.

"I have only to add, that if the jury of the Universal Exhibition of Paris had examined and understood the merit of the patent sheet plate of Messrs. Chance's, it would have been sufficient to induce that jury to have awarded them the highest class of reward."

The CHAIRMAN said they had been favoured with some very valuable information, but altogether from manufacturers. It would, however, be very desirable to have some remarks from consumers of glass, and as he saw his friend Col. Challoner present, who, in his position as an agriculturist, was a very large consumer, he should call upon him for a few observations.

Col. CHALLONER said his observations would merely go to the very great blessing which Sir Robert Peel had conferred upon this country when he took of the duty from glass. When he (Col. Challoner) came from Italy he wanted to know why he could not have the same large panes of glass as at Naples. He applied to Mr. Hetley, a manufacturer in Soho-square, on the subject; that gentleman told him they could not make them. He explained to Mr. Hetley that in Italy they blew the panes of glass into what were called muffs, and opened them by a hot iron, and then put them into furnaces, and they then became perfectly flat. Mr. Hetley said they could not apply that process in this country with advantage, in consequence of the heavy duty. Panes of glass for his conservatory, which at that time—before the reduction of the duty—cost him sixpence a piece, could now be had for a penny. Those connected with horticultural pursuits must feel deeply grateful for the great measure of Sir Robert Peel. He must be allowed to thank those gentlemen who manufactured glass so cheaply, doubtless at a good profit to themselves, as well as to the advantage of the consumer.

Professor TENNANT said that Fontainebleau sand was not, as was supposed, composed entirely of silica, but contained a large proportion of carbonate of lime, thus acquiring a most singular quality—the property of crystallisation, taking one of the forms of carbonate of lime. In *Shepard's Treatise on Mineralogy*, it is termed "crystallised sandstone of Fontainebleau," and is described as "a variety of calcareous spar mechanically mixed with sand" (*Chaux carbonatée quatzifère* of HAUY). With reference to the colour in the glass, it was due to the chemical action produced by the sun's rays, and was to be observed more particularly on the houses having fronts exposed to the south and west. This would be found to be the fact on examining the windows on the north and east sides of the streets of London, and was particularly remarkable in the windows of a house opposite the Star and Garter, at Richmond. This was attributable to an excess of the oxide of manganese, and not to oxide of iron. He concurred in the remark that Sir R. Peel had conferred a great boon upon England by the repeal of the duty on glass. This was one great step in advance. The next was the abolition of the window duty. Previous to the latter change, it was the custom of builders, on all possible occasions, to build houses with as few windows as practicable, in order to avoid the duty—a practice most prejudicial both to health and comfort—for the continuance of which, however, there was no longer any excuse.

Mr. VARLEY could corroborate what Mr. Wilson had stated of glasses having a moisture, by which they sometimes stuck together. He was once shown some very large glasses, by a gentleman who had the largest silvering slab in London. They were beautifully clear, but appeared to be covered with steam, which, when wiped off, appeared again. He had applied to Professor Faraday, in hopes of learning how to cure it. On examining these glasses with a magnifier, the apparent steam was found to consist of very minute but long crystals, which shape indicated nitre, showing that so much potash was used in the manufacture of the glass, that it exuded, and with the air formed nitre. Now repeated washings, (a most serious job with 8 or 10 feet plates), might much lessen the exudable matter. But the glass having become porous all over, a serious injury, as regarded its power of transmitting or reflecting light, resulted. What was still worse was, that such glass could never be wiped so as to remain clean, for the wiping filled up the pores with what should have been quite removed. This began again to exude in minute gummy dots, which continued to enlarge, and on again wiping, smeared the surface, rendering it difficult to clean. Soda was prone to dry and lose its water of crystallisation. Potash, on the contrary, attracted moisture, and became liquid. From this, it would seem that soda would make a more durable glass than potash. As regarded a defective surface, Mr. Varley had had many lenses polished on a composition of bees-wax and polishing-powder. This would not hold anything firm enough to scratch and give it an absolute continuous surface, for it would not spring, and if any part was forced away, it remained there out of action till the remainder was brought to the same level. Therefore such lenses were perfect in surface and in figure to their very edges, and these lenses were easily wiped clean with the same kind of leather that would scarcely wipe another one, as usually polished on a soft springing material, which left a minute waved surface (a serious defect in the lens), into which the leather could hardly dive to wipe it clean. This mode of polishing, when on glass that could exude its alkali, or other matter, and so become porous, the pores would hold food for what was known to opticians as vegetation, which often occurred between lenses when they were put together. As to colour, Mr. Varley had sought for clear and colourless glass to enclose water-colour pictures, and had found some colourless; but on looking through the edge, it was seen to be very much darker than some coloured specimens. This would rob the pictures of so much light as to render them gloomy. Ordinary glass was greenish or bluish. The glass became green by destroying just so much red light, and the red that was put in to neutralise it had destroyed so much blue and yellow light; therefore, when mixed, this red obstructed the free blue and yellow rays, and the green obstructed the free red rays, and the result was just so much black glass mixed with the white; and pictures covered with it, or telescopes made with such, suffered equally from loss of light. The only remedy was, not to doctor the materials, but to seek for pure materials, and keep them so during the process of melting; perfectly mixing the ingredients, if possible, to make them all dissolve into each other, to produce real homogeneity.

Mr. W. **Bridges Adams**, through the Secretary, made the following remarks:—

"The subject of the manufacture of glass may very naturally lead to that of the usage of glass for keeping out the weather, and more especially in connection with skylights and green-houses, which are proverbially leaky. This leakyness arises from the want of any provision for expansion and contraction. The putty which connects the glass to the frame is, while new, a plastic substance; when old, a brittle substance. Contraction after heat, therefore, necessarily produces an open joint, either between the putty and the glass, or between the glass and the frame. The putty is analogous to the caulking of ship's decks, composed of plastic pitch and oakum. When the pitch by age ceases to be plastic, the shrinkage of the planks produces open joints in hot weather, the remedy for which is to keep the planks saturated with water. Until, therefore, a caulking is used for glass in skylights sufficiently elastic to keep the joints close under varying temperature, and by reason of its elasticity not subject to damage, a rain-tight skylight cannot be produced unless by the process of making the glass in a single sheet, with the edges bent down all round, to lap over a projecting fillet in the manner of a ship's hatches.

"There is a process which has been used for ages analogous to the object in view. By means of elastic cork, wine or alcohol is kept for an unlimited period unwasted in glass bottles. If, therefore, instead of making cylinders of cork we prepare long parallellograms or strips, and place it between the edges of the glass and the framings, we shall produce a similar result. In this mode skylights may be made impervious to rain. The application is very simple. The glass may either be slid into grooves lined with cork, or placed in open rebates, bedded on cork, or with cork round the edges, or both, or the glass may simply be laid on the frame with a bedding of cork below, and with wood fillets overlaying the glass to keep it in position and in contact with the cork, screwed or nailed down.

"Specimens of cork strips are laid upon the table. Time did not permit, or samples of this kind of glazing would have been shown. Some will be prepared for the approaching Exhibition of the Society. The cost of the cork will be from one halfpenny to one penny per yard run."

The **Chairman** said, the white American flint glass exhibited at the Great Exhibition, was a complete illustration of Mr. Wilson's remarks. It had a colourless appearance, and at first sight was somewhat attractive, but on looking at it more closely, it had no brilliancy. No allusion had been made to glass of zinc, which had been the subject of a reward at the Exhibition of 1851. It certainly had a very pleasing and white appearance, and was specially suited to achromatic purposes. It had the remarkable property of being of greater specific gravity than flint glass, and was much more pure and pellucid than glass of lead, which could be only made applicable to achromatic purposes by constant agitation. Thus, by changing the chemical ingredient, heavy glass was produced without agitation, which was necessary with glass of lead or flint glass. A remark had been made about manufacturing kelp, which reminded him of an anecdote. Some time last year he formed one of a number of gentlemen (manufacturers, though in quite a different branch to himself) who attended as a deputation to Lord Palmerston, when the subject of chemistry was alluded to to supersede the use of manure for leather tanning, &c. In reference to the subject under discussion, Lord Palmerston enquired, Why not produce it by chemical means, when an aged manufacturer present asked Lord Palmerston whether he ever knew a chemical manufacturer that did not get into the *Gazette* in six months. There was a good deal of truth in that remark, though he did not wish to deter anybody from attempting to reproduce kelp, guano, or any other production of nature. Time was going on, and he hoped all those difficulties in the way of science would rapidly be removed. There were many other subjects he would have noticed had time permitted, for lovers of his profession must not only look at in a pounds, shillings, and pence point of view, but as poets, philosophers, and chemists. He would congratulate their friend Mr. Wilson on being so successful a manufacturer of those silver plates by which beauty could adorn herself at the toilet, and their friend, Mr. Claudet, for having so perfected the means of fixing that beauty in porueful traits on the same material. Both were extremely in their way. He concluded by moving the thanks of the meeting to Mr. Chance for his able and valuable paper.

Mr. **Wilson** moved a vote of thanks to the Chairman, which having been carried unanimously and acknowledged,

The Secretary announced that the paper to be read on the evening of Wednesday next, the 20th instant, was "Recent Improvements in Carpet Manufacture, their Use and Abuse; with a Word on Beauty and Deformity in Carpet Design," by Mr. Alexander Whytock. On this evening Mr. Peter Graham will preside.

The **Secretary**, since the reading of the paper, has received a communication from a gentleman who was present at the discussion, from which the following is extracted:—"I have found that common window glass, if kept fused for two hours in a current of atmospheric air (which is heated to the same point as the melted glass), becomes almost colourless, but I have not yet succeeded in depriving it of the whole of its colour. The fact of the partial removal of colour by oxygen, leads me to differ with Mr. Frederick Pellatt, who expressed it as his belief. that the colour was due to the absorption of oxygen. I am inclined to believe that the brown or black colour which was spoken of by Mr. F. Pellatt, as also by Mr. Wilson (as appearing after some time), is due to the formation of binoxide of manganese. I would suggest whether the amethyst colour which is also seen in glass which is colourless, may not be due to the disappearance of the green tint, by the peroxidation of the iron, and consequent removal of that which had neutralised the amethyst. It is much to be regretted that glass manufacturers are not in a position to tell their foremen to try certain experiments and see that they are carried out, for I have lately had permission of a glass manufacturer to use his furnaces, and he himself has ordered his men to try the experiments, but instead, I am told that the glass will not take the stuff, and it is of no use. This is distinctly a rotten system, yet I believe it is universal."—G. F. A.

Colonial Correspondence.

THE NATURAL RESOURCES OF JAMACIA.

Sir,—The pages of the *Journal* being at all times freely devoted to the advancement of the Arts, Manufactures, and Commerce of our Colonies, offer a fit channel for a notice of the proceedings of the Jamacia Society of Arts, which has now passed its first anniversary, with steadily increasing encouragement to the executive body.

Its most prominent effort was the contribution to the Paris Universal Exhibition, which contained a list of no less than 668 articles, including a large variety of samples of the raw and manufactured produce of the island and specimens of its natural history. The success of this endeavour to make known the boundless resources at command, is fully established by the reports of the jurors, and I propose, with your permission, to aid the movement by allusion to a few prominent features of the collection.

The Geological Selection contained many valuable *fossils*, lent for the occasion by the Honourable Edward Chitty, one of the local judges; of whom it must be mentioned that by his researches, aided by those of Professor Adams, the Island of Jamaica, so comparatively small in its area, has been found to open the largest proportional field in the known world for the land and fluviatile conchologist.

The *minerals* consisted of specimens taken from the various local mines opened, and in course of exploration; with many specimens of marble, silicious sand, and white lime-stone, which, though soft when quarried, becomes hard after exposure.

A fine sample of *lithographic stone* was also exihbited, supposed to be of the Lias formation, which is reported to have been lately found in large masses. This discovery seems to be of great importance, and it is hoped that large specimens will soon be forwarded to this country.

The *forest products* included a valuable collection of woods and fibres. The former were prepared for exhibition in a very effective and efficient manner, and experiments were made by competent authorities to test the power of resistance of many varieties. The result will, I have reason to believe, shortly be made public. The entire series has been secured for the museum at the Royal Gardens, Kew. Of the variety of fibres, it is to be regretted that the samples forwarded were so small that experiment was next to impossible. They were prepared by the curator of the local Botanic Gardens, who reports that the island can boast of possessing the finest fibres and the greatest number of textile plants in the world, all of which are capable of being turned to the best account. Certain it is that the list comprised fibre of such quality and colour—from the cocoa-nut coir to filaments resembling fine silk—in strength and lustre of appearance scarcely to be surpassed.

In the collection of *vegetable products*, ample samples of the staple products of sugar and rum were naturally looked for, but in this particular there was a very damaging deficiency. This is much to be regretted, as the produce of various systems of manufacture was exhibited, but in so small a measure as to preclude comparison. The absence of all statistics, which are of the utmost importance in testing the relative merits of various systems, is also to be noticed with regret; but while these defects were freely commented on, the extensive series of *lesser staples* called forth very general satisfaction. Even though the landowners have for many years loudly proclaimed the gradual decline of sugar cultivation, these minor yet highly important products have been wilfully neglected; but this rejection of the gifts of nature must not longer continue. In this department may be mentioned arrowroot, cocoa, and prepared chocolate; tobacco, cigars, and snuff; cayenne pepper; gums; citric acid; preserves; pickles, &c.; all of tried and appreciated quality.

Among many samples of oil, one attracted more than ordinary attention. It is expressed from the seed of the Moringa (*M. pterygosperma*), which tree thrives in the hot sandy plains, and is grown from cuttings. This oil is very similar to the famous oil of Bheu, and is said to be possessed of the following properties, viz:—1. Never gets rancid. 2. Tasteless, odourless, and nearly colourless. 3. Thin and limpid. 4. Does not corrode, and does not freeze except at a very low temperature. 5. Believed to be superior to Colza oil for burning, and equal to the best olive for culinary purposes.

Another oil, made from the seed of the Sand box, (*Hura crepitans*) seems to offer a valuable addition to the Pharmacopœia—twenty drops being equal (as certified by local physicians) to a table-spoonful of castor oil, and the taste is much less disagreeable.

Some biscuits were exhibited, prepared by the simple process of drying the yam, cocoa, and bread-fruit, which vegetables are much used in the West Indies in lieu of bread—hence called bread-kind. Samples of these biscuits should be duly analysed, as they may become very valuable provision for ships, &c.

Perhaps the most intrinsically valuable contributions were those of edible seeds, fruits, and roots, accompanied by samples of the flour and starch yielded by those plants. Mr. Simmonds has, in a late number of the *Journal*, called attention to the necessity for the production of new farinaceous substances, and specified many of these very products as among the farinas most useful for food and the purposes of our manufactures. If the Jamaica Society will but follow up this effort to introduce these new articles of commerce, it will not only aid the colonial agriculturist, but release much grain now absorbed in the shape of starches.

The value of an apiary in Jamaica was fully tested, and the produce has been much inquired for. The virgin honey was well nigh as clear as crystal; the unbleached wax, from the same comb, was almost white; and the vinegar made from the refuse of the comb, is of extreme delicacy.

It is only doing justice to the executive body of the Jamaica Society of Arts, to state that they brought together and exhibited a very interesting representation of the resources of the island; and the judgment and energy therein necessarily involved, premises much for the success of the larger objects embraced within the proposed plan of operations. It is, indeed, a satisfaction to read the reports of the various Committees, and I am tempted, in conclusion, to make one or two extracts therefrom, as evidence of the spirit which actuates those who so worthily devote their time and abilities to the best interests of the colony.

They have adopted the advice of Viscount Ebrington, addressed to this Society at the opening of the 101st session, and are striving to overcome that "indolent acquiescence in leaving ill alone," which they declare to be so prevalent among the inhabitants.

The Paris Exhibition Committee, modestly enough, admit that it would have been idle for the Society to venture upon a competition with the artistic skill and manufacturing enterprise of European countries, but it was hoped that by the impetus created by the efforts they made, a new era would be opened up for the industrial pursuits of the island, and that many new articles of commerce might be brought into the markets of the world. In allusion to the collection (as exhibited in Jamaica, before transmission to Paris,) it is said to "speak to the spectators in the language of popular instruction;" and the opinion is expressed that there ought no longer to exist an unoccupied class amongst the population, as all can become producers, and thereby gain a decent livelihood, while adding to the general prosperity. It is hoped that the day is not far distant when Jamaica shall possess a museum of natural products, manufactures, and arts, and that annual exhibitions will become organised sources of improvement and enjoyment.

From the "Transactions" of the Jamaica Society of Arts I find that the Council is earnestly at work, endeavouring to secure contributions for a local exhibition, to be held during the early part of this year, and that much progress has already been made in the preliminary preparation necessary for the foundation of a permanent museum, in which latter effort I trust the Society will receive, as far as may be practicable, the hearty assistance of all kindred Societies in this and other countries.

AN OLD COLONIST.

Home Correspondence.

RELATIONS OF THE KILOGRAMME, ZOLL-CENTNER, OR QUINTAL, TO ENGLISH STANDARD WEIGHTS, ACCORDING TO VARIOUS AUTHORITIES.

Weight of Kilog. in Grains.	AUTHORITY OR BASIS.	Corresponding weight of 50 kilogs., being the Zoll-centner or Quintal, in lbs. avoirdupois.
15,432·348	Scientific Commission appointed by the Treasury	110·231
15,432½	The French Mint	110$\frac{13}{56}$
15,434	The United States Mint	110$\frac{17}{70}$
15,434$\frac{1}{12}$	On the basis 10,000 oz. troy = 311 kilogs.	110$\frac{426}{1750}$
15,435	On the basis 63 cwt. avoir. = 64 centners. " 441 lb. do. = 200 kilogs.	110¼
15,446[illegible]	The Board of Trade, in re Dutch Weights, *vide The Gazette*, 29th January, 1856	110[illegible]
15,470	The Board of Trade, 1855:—"Statistical Tables relating to Foreign Countries."	110½

SIR,—At this conjuncture, the tabulated form given above may usefully illustrate the disparities to be overcome in order to maintain precise correspondence between weights ostensibly identical. Some of the discrepancy is, no doubt, attributable to the practice of making the kilogramme of commerce a little heavier than the platinum standard in Government charge, by way of compensating for the "draft of the scale," which is commonly given with weighed commodities. Some further discrepancy may be due to the well-known tendency of ordinary metal weights to become heavier by oxidation.

In converting French, German, Dutch, and like weights into English equivalents, I find it convenient to assume—

311 kilogs. = 10,000 oz. troy; or
200 do. = 441 lbs. avoirdupois.

Those English quantities are slightly in excess of the two authoritative valuations at the head of the table, but may be reduced to them approximately by deducting one-sixth per mille, or, still closer, 17 per 100,000.

The numbers on the line commencing 15,435 are all composed of convenient factors, *e.g.* $15{,}435 = 7^2 \times 5 \times 3^2$.

Disregarding fractions of a grain in the first two lines, it is easy to recollect that 123,456 grains equal 8 kilogs. of 15,232 grains each.

An ingot of English standard-gold weighing 123,456 grains = 257⅕ ounces troy, is, within say ⅙ per mille, exchangeable at Bank rate (77s. 9d. per oz.) for £1,000 precisely; and 22 such kilogs. of fine gold are exchangeable for £3,000, precisely.

If the ingots prove heavier by, say ⅙ per mille—*i.e.* 15,434$\frac{1}{12}$ grains per kilog.—the exchangeable values will be the round sums £1,000 and £3,000 respectively, without deductions.

Yours, &c.,
J. A. FRANKLIN.

London Institution, 1st February, 1856.

P.S.—I hear that it has been proposed to the Monetary Congress still sitting at Vienna, to adopt as a gold basis a coin equivalent to our sovereign, as referred to in my letter in the *Journal of the Society of Arts* of the 21st December last.

ON ENGLISH DECIMAL COINS.

SIR,—Several countries, as China, Russia, and Portugal, which have a very small unit of account, of necessity have had a decimal system of account from the earliest period. Some other isolated states, as Rome, divided their coin in a decimal manner before the end of the last century; sometimes, as in Rome, the decimal and the mixed system being in use at the same time. Jefferson, in America, shortly after the separation from England, proposed to take the Spanish dollar as the unit, and divided it into 100 parts, a coinage exactly like that existing in Rome. France, shortly after, followed the American lead, and divided its *franc* or *livre* into 100 *centimes*.

But it appears that an English Company, the Sierra Leone Company, probably influenced by the discussion in America, at any rate were the first to issue a series of decimal coins. They put forth, in 1791, four beautifully executed silver and two copper coins, all bearing a lion on one side and a pair of hands united in friendship on the other. The pieces are called a "one dollar," "half dollar," "twenty cents," and "ten cents piece," and marked in numbers, 100, 50, 20, 10. The copper coin is called a "one-cent. piece" the size of our half-penny, and the other "one-penny piece," thus retaining the name of that universal coin. These coins are in my cabinet. The earliest American decimal coins I have seen, are dated 1794, and the earliest French are dated ann. 5 = 1797.

The Sierra Leone dollar is said to be divided into 10 matucas by the negros, who use the latter as their unit of account.

Yours, &c.,
J. E. GRAY.

Feb. 10, 1856.

TONNAGE REGISTRATION.

Woolwich Dockyard, Feb. 9, 1856.

SIR,—I beg to acknowledge having received by the *Journal of the Society of Arts*, of the 8th inst. the letter which Mr. W. S. Lindsay has been pleased to address to me on the subject of my paper on Tonnage Registration, read before the Society of Arts on the 16th ult. I do not think that any gentleman not personally interested in this question, and familiar with the freedom of speech permitted in discussions of this character, will, on deliberately reading my paper, attach to my arguments the construction which Mr. Lindsay has assumed. I have based my arguments on general principles, and I disclaim all personalities,—first of all, because I do not feel them; and next, because, if I were so actuated, the bandying of such irrelevant matter would distract attention from the real points of this discussion. I do not challenge the *substance* of the Merchant Shipping Act of 1854, but I assert its *deficiencies* in so far that under this Act the published tonnage registration of shipping does not inform the public of the tons weight of cargo that ships will safely carry, or the tonnage measurement of cargo that a ship will hold; also, by this Bill, the deep loading of ships, on which safety at sea so much depends, is not subjected to any legally recognised control; nor are the data essential to the scientific analysis of the properties of ships at all embraced by our present system of tonnage registration, as prescribed by the law of 1854.

The general question as to the effect of insurance brought under consideration by my paper, is not met by special allusion to individual practice, as referred to by Mr. Lindsay; the question is, whether the fact of a ship and its cargo being well insured against loss at sea, tends to check imprudence in the loading of ships, to which no 7 limitation is assigned by law.

Further, as no useful conclusions can result from discussion unless the objects under discussion be clearly defined, I would question what Mr. Lindsay means by the observation that the tonnage registration under the Merchant Shipping Law of 1854, "has given every satisfaction to the interests who are the best judges of its merits, or for whose benefits it has been established." The construction which I put on the Merchant Shipping Law of 1854 is, that the interests and benefits intended to be served by the operation of that law are not those of any particular class, but of the public at large, whose interests and benefits are greatly dependent—first, on the effectiveness of statistical registration for promoting the purposes of maritime discipline, as dependent on the capability of a ship for weight cargo being known (a matter somewhat touching the *income-tax*, perhaps);—secondly, for affording data for pointing out the conditions under which the transport of grain and other merchandise can be effected at the least cost of freight (a matter somewhat touching the *price of bread*);—and, thirdly, for subjecting the deep draught of vessels on leaving port to official supervision (a matter somewhat touching the *liability to wreck*);—none of which points are embraced in the law of 1854. If we do not agree as to whether the intended object of the law referred to was protective CLASS LEGISLATION or legislation for the PUBLIC GOOD, we need no longer to discuss the subject; and even if we do agree on this point, if Mr. Lindsay disclaims being able to perceive the use of these details of statistical registration wherein the present law is deficient, as means for the attainment of the objects above referred to, why, really, all I can do further for Mr. Lindsay in this matter is to refer him, as I have done others in the like emergency, to study a certain essay, entitled "Atherton's Steam-Ship Capability," 2nd edition, published by Weale, especially the supplement thereof, exemplifying, what is called in the preface to the work, "the Arithmetic of Steam Ship adaptation to the requirements of Mercantile Service,"—a study peculiarly called for in the present aspect of shipping affairs.

I am, Sir, your very obedient servant,
CHAS. ATHERTON.

TONNAGE REGISTRATION.—LIABILITY OF BRITISH SHIPOWNERS.

SIR,—The communication of Mr. Atherton, which appears in No. 166 of the *Journal of the Society of Arts*, requires a few words from me in reply, in order that "the public may have the truth" as to the liability of British shipowners in the event of loss of life at sea. Mr. Atherton quotes the substance of three or four clauses of the Merchant Shipping Act 1854, to show, as he says, the extent of the penalties to which shipowners are liable under the Act; but, as if determined to carry out his principle of *displacement* in all matters, and even in support of an error, which I have no doubt he has inadvertently fallen into, he puts forward a few minor penalties in place of the "stringent provisions in regard to the sea-worthiness of ships," to which I still affirm the British shipowner is subjected, under the Merchant Shipping Act 1854, and which, as I stated in the discussion that followed the reading of Mr. Atherton's excellent paper, will be found to inflict heavy penalties in the event of loss of life at sea through the unseaworthiness of ships, from whatever cause it might arise. Part IX. of the Act is entirely devoted to the liabilities of shipowners, and, from its having a special heading to denote this fact, it cannot be easily overlooked. It declares, among other things, that:—

"Where any loss of life or personal injury is caused to any person being carried in a ship, the owner shall not be answerable in damages to an extent beyond the value of his ship and the freight due, or to grow due, *the value; in no case, to be taken at less than £15 per registered ton.*"

"The damages payable in each case of death or injury shall be assessed at *thirty pounds*."

These, be it remembered, are liabilities to which the shipowner is subject when the accident or loss occurs "*without his actual fault or privity*," and in order to show the operation of this part of the Act, it is enough, perhaps, to refer to one case which occurred within a week after the statute became law. It is, in fact, one of the 1799 cases of shipwreck recorded in the *Shipping and Mercantile Gazette* during the year 1855, in regard to which Mr. Atherton invites me to "take the pains to show the penalties" attending the loss of life. In May last the emigrant ship *John*, bound to Canada, with about 300 lives on board, was lost off Falmouth, through the incompetency of her commander, by which incompetency, of course, the ship was rendered unseaworthy. The greater number of the passengers unfortunately perished; the penalties of the Act were consequently put in force, through the Marine Department of the Board of Trade; and as Mr. Atherton has referred me to the columns of the *Shipping and Mercantile Gazette*, I cannot do better than quote the remarks of the editor of that journal on this very case, to show the extent of the supervision of Government in regard to the seaworthiness of ships, as well as the nature of the penalties to which shipowners are liable in the event of loss of life. The clause of the Act to which I have referred, it will be remembered, declares that, in estimating the damages, the value of the ship shall not be taken at less than £15 per ton. The *John* was 465 tons register, and the editor, it will be perceived, complains of the injustice, on the part of the legislature, of fixing this arbitrary estimate,* which, he says, must in many cases involve an amount of more than three times the value of the property on which the liability is incurred. But I will let the editor speak for himself:—

"Would any of our readers, acquainted with the value of shipping, have been disposed to purchase the *John*, before she left Plymouth, at one-third of £15 per ton, or, as the figure would stand according to the Act, of £6,975. Here is a ruinous liability of, say £7,000., thrown on property that would, in all probability, be highly estimated at £2,000. But this is not all. In the present case, involving as it does a calamitous loss of life, the responsibility may not stop at the *minimum* estimate of the Act. We find in clause 510, which directs the distribution of the penalty, that one of the rules to be observed as to damages thus recovered, and the application thereof, is as follows:—

"The damages payable in each case of death or injury shall be assessed at *thirty pounds*."

"Now, presuming that all who were on board the *John*, being 263 souls, have sustained more or less injury (most of them, unfortunately, are dead), the amount, at £30 per head to be so distributed, would be £7,890; which sum, it should be observed, the Act declares shall be *first* applied; that is, before any other claims as to loss of property, &c., shall be satisfied. So that, under this *minimum* estimate, there is positively no limit to the liability which might be inflicted on a shipowner by the Act, and which, under the mildest form, we have shown to be ruinous."

These are some of "the heavy penalties" to which I referred Mr. Atherton in the few remarks which fell from me in the discussion which followed the reading of his paper; and I feel that I cannot better instance the nature of "the supervision of government," and "the stringent provisions in regard to the seaworthiness of ships,"—with which, I ventured to submit, the public ought to be acquainted—than by quoting another paragraph from the same article. The writer says:—

"But the question will naturally occur—Why punish the shipowner at all for an act—it may be 'of God'—or, at all events, declared by the law itself to occur 'without his actual fault or privity?' It should be remembered that by Act of Parliament the shipowner is, in a manner, relieved of the chief responsibility in respect of his ship and her appointments, as well as in regard to the ability and efficiency of her officers and crew. The law provides that the Government officer, appointed for the express purpose, *shall see and satisfy himself that the ship is in all respects in a fit and proper condition to undertake the intended voyage*, and that the appointments are strictly in accordance with the provisions of the Act, which set forth the requirements to the minutest details. He is further commanded not to permit the ship to proceed to sea until he is satisfied that she has on board, at the time of clearance, a full and efficient crew, which, as it regards number, is also carefully described in the Act, in proportion to the tonnage of the ship. The owner, moreover, is forbidden, by the law, to place in command of his ship—be he master or mate—any but what are declared, by the examiners appointed under the Act, to be *competent* in all respects to navigate her, and fit to be entrusted with the lives and property on board—for which, notwithstanding, the owner is made liable in the event of accident. You first tell the shipowner, by your special surveys and inspections, that he has a good and sufficient ship for the given voyage, according to Act of Parliament; that she is in all respects well-found, appointed, and manned, according to Act of Parliament; and that she is commanded and officered by competent or experienced men—to whom certificates are given as vouchers of the fact, for the satisfaction of the owner, as well as the public—also according to Act of Parliament. It will thus be seen that the Government takes upon itself the responsibility as to the fitness and efficiency of the owners' property and servants—from the hull to every incidental appointment in the ship, and from the captain to every individual sailor;—and yet, at the same time, in the event of loss, whether from accident or incompetency, it shifts the whole *penalty* on the shoulders of the shipowner, who has merely been a passive instrument in the hands of the law, and who has, of necessity, complied with all its requirements."

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* Vide *Shipping and Mercantile Gazette*, May 18, 1855.

I think it will thus be seen that, however much shipowners might be disposed to be regardless of the safety of life at sea, the legislature has not left them "to do as they please with their own," to the public detriment, as Mr. Atherton, in contrasting our maritime with our railroad system, would lead us to infer. I need not, therefore, occupy your valuable space in discussing with Mr. Atherton the question of the comparative honesty or "commercial cleverness" of British shipowners, as exemplified in their alleged approval of the present mode of Tonnage Admeasurement in preference to his. I may, however, state my conviction, that not one in ten of our shipowners knew anything whatever of the nature or tendency of the new tonnage law until it was in full force, and that very few more, if any, are even now much better acquainted with the subject.

I am, Sir, your obedient servant,

WILLIAM MITCHELL.

54, Gracechurch-street, City.

EXAMINATION OF CLASSES IN INSTITUTES, AS APPLICABLE TO THE COLONIES.

Sir,—As a member of the Jamaica Society of Arts, and during my residence in England one of its general agents, I submit a few remarks relating to the system of awarding certificates or diplomas to students of classes in such Institutes as are in Union. I do so with the less hesitation having pressed the subject of Union with Colonial Institutions upon the Council, urging the expediency of such extension.

The following extract from the minutes of the proceedings of the Jamaica Society of Arts, will afford some evidence that the subject has for some time occupied my attention:—

At a Meeting held at the Court House, Kingston, on Wednesday, 9th May, 1855, *His Excellency the President in the Chair,*

Mr. Valpy gave notice of the following resolution, which he would submit for consideration at a future meeting:—

"That a committee be appointed to consider the plan proposed by the Council of the Society of Arts for the examination of, and granting certificates to, students of classes for adult instruction in Societies in Union, and to report whether this Society, if received into Union, can, with any prospect of benefit to the inhabitants of the island, co-operate in such plan."

From the moment that I had perused the memorandum published in your *Journal*, vol. ii., No. 102, p. 821, I was impressed with the belief that a modified plan might be made to exercise an important influence on educational training in the Colonies. If it be true that in England sufficient inducements have not been generally given to the members of the various Institutes to pursue systematic studies, which defect it is intended to remedy by stated examinations, accompanied with the reward of a certificate or diploma, whereby it is hoped to supply some of the advantages which are so abundantly offered to the higher classes of the community in their competitive examinations, honours, and degrees; if, I say, such a system is required in England, surely the want must be felt with largely-increased force in the Colonies, where even the competition for collegiate honours and degrees, so widely extended in this country, has become far beyond the reach of the depressed colonists.

In Jamaica we have some good preparatory schools, but beyond this point there is no stimulus to excite emulation. As soon as the bounds of school discipline are removed, the mind wanders in the wilderness of light literature and unprofitable amusement, finding no support on which to climb to eminence in any branch of study.

It is naturally felt that the inhabitants of each country or district should enjoy the emoluments, as well as the other advantages of those Institutions which are supported by local taxation; and it is a matter of deep importance that the candidates for office should be specially trained and completely educated. Here is the point at which the existing school system fails. Some of those gentlemen who are engaged in the work of education are fully competent to carry on the studies of their pupils to full proficiency, and the mental endowments of the scholars are by no means deficient. The absence of all competitive stimulus for degrees or honours, is the great want in our present prostrate condition.

It seems to me that this requirement may, in a great measure, be supplied, if the system of examinations for certificates or diplomas from the Society of Arts can, practically, be extended, in which case much benefit would be derived by the colonists, and the influence of the Society would be greatly increased. A candidate for patronage and employment, having such a certificate in his possession, would be placed in an advanced rank amongst the competitors, and his claims would not be lightly passed over.

The ability of each separate colony to adopt such a system as is proposed, must depend on local circumstances, so widely dissimilar, that I believe it will be impossible to develope and determine upon any fixed plan, and I would venture to suggest that the Council of the Society of Arts should authorise each Colonial Institute as accepted in Union, to report the plan by which it shall consider the system can best be brought into operation in that particular colony, together with such rules for local guidance as it may deem requisite, at the same time appointing an agent in England to mature the plan and settle the rules with the Council. From my knowledge of colonial life, I believe it will be necessary in all Colonial Institutes to dispense entirely with classes, as it would be impossible to secure attendance for study in such form. The 5th condition, as published in the number of the *Journal* already noticed, on which Associations (or Local Unions) are taken into Union, seems to provide a remedy for a similar anticipated difficulty in some parts of England. I would also propose that the examinations should be open to students of all ages, whose names should be previously entered on the books of the local Society as candidates; but I must not be tempted to enter into detail at this period.

There are men in the colonies fully capable of undertaking the responsible position of examiners, and the fact of a local examination (if scrupulously and independently arranged and conducted) would give increased local influence to the certificate, and there would, doubtless, be a friendly interchange of confidence between the several colonies.

Considerable time must necessarily elapse before any Colonial Association can, under any circumstances, be found in a position to present candidates for examination, and I am desirous that these, my views, if they appear to the Council to be worthy of consideration, shall, by publication in the *Journal*, be submitted to all such Associations, in the hope that their attention may be called to the subject, and their opinions elicited.

LEONARD ROWE VALPY.

Addison-road, Kensington,
23rd January, 1856.

Proceedings of Institutions.

Halstead.—On Tuesday evening, the 29th ult., the annual *soirée* of the Mechanics' Institution took place. The attendance on this occasion, and the character of the entertainment, were superior to that of any previous year. This is the more gratifying and encouraging from the fact that the whole machinery put in motion for the evening's entertainment was confined entirely, so far as extempore addresses, and the performance of music, and the singing of glees, &c., went, to members of the Institute. After tea, *Non nobis Domine* was sung; and, while preparation was being made for the crowded audience to listen to the addresses, the company adjourned to the "Board-room," where was exhibited a large number of valuable photographic sketches and prints lent by the Society of Arts and E. Hornor, Esq. There was also an extensive collection of minerals, the property of the Institution, and a cabinet of coins sent by the Rev. Charles Burney; Messrs. Flavell and Brown contributed other coins and cases of birds. There was likewise a small printing press at work, throwing off, in considerable numbers for immediate demand, a humourous poetic effusion by a member of the Society of Friends, having especial reference to the celebrities of the locality, both past and present, the profits of sale being appropriated to the benefit of the Institute. Having returned to the hall, G. W. Harris, Esq., V.P., took the chair, and, in a congratulatory address to the audience, introduced Edward Hornor, Esq., the president of the Institute, who, for three-quarters of an hour, gave a very interesting account of his late trip to the Pyrenées, interspersing it with graphic sketches, both of scenery and different shades of character with which he came in contact. He narrated some interesting anecdotes of his travels by sea and land, and these were given with much effect, and were highly applauded. Mr. Davison was then called upon by the chairman. He gave an interesting description of New Zealand, where he formerly resided. After some more singing, the Rev. W. Clements read an elaborate paper "On Fine Art among the Jews." In tracing the artistic skill of any ancient nation, he observed, it is obviously important that we possess monumental remains; verbal description fails to convey that accurate conception essential to a correct acquaintance with works of art. Happily, we were favoured with such aids in tracing the artistic skill of many ancient nations. Assyria, Egypt, Greece—all furnish abundant monuments. It is otherwise with the Hebrew nation, since we are thrown almost exclusively on its writings. The interest, however, gathered around this nation will ever secure for it veneration, and although there are many points of far higher interest, yet, even in that of its artistic skill, there is sufficient attraction to awaken inquiry and sustain a spirit of investigation. Thrown, as we are, upon the literature of the Hebrews, our only means of acquainting ourselves with the principles and details of their works of art is the study of these. In so doing we should discover they were far advanced in artistic skill and wisdom. Mr. Clements here entered into a review of their power, by a description of the varied departments of art in which they excelled. They were skilled in the art of metallurgy, gem sculpture, sculpture in wood; also in the lighter departments of embroidery, weaving in colours, dyeing, working in leather, spinning, the manufacture of fine linen, and the preparation of oils, perfumes, and unguents. Details of these were indicated by descriptions of the Tabernacle and its furniture, the robes of the Jewish priests embellished with polished gems, &c., &c. If the learned researches of men who had studied the characters and symbols on the rocks of Sinai really resulted in demonstrating a Hebrew origin for those characters and symbols, and an origin of the date of Israel's sojourn in the Wilderness, then had we in these rocks monuments of Hebrew art, as deeply interesting as those of Assyria, brought to light by Layard. But, with this exception, all monuments of Hebrew art had long since perished, and vain was the hope that another Layard would arise to uncover the sepulchres in which they were buried.

> "All is silent now, and Zion's holy place,
> Trodden under foot and mingled dust with dust."

It becomes an interesting inquiry, Whence the Hebrews derived their skill, and borrowed their types?—Israel's abode in Egypt had been singularly confirmed by recent monumental remains. Their testimony is, "That Israel dwelt in Egypt, and laboured on the public works at the very time when some of the grandest and most beautiful edifices were constructed in the valley of the Nile." Whilst this fact bore witness to the truthfulness of the Mosaic writings, how clear is it, that the Jews owe their artistic skill to Egypt, and that thence they borrowed their patterns, for it is inconceivable that a people so long cradled in a nation in the highest state of civilisation and art, could come out thence without largely partaking of the manners of that nation, and be imbued with a spirit of its artistic skill and wisdom. In the absence of monuments peculiarly Jewish, it is obvious we may study the principles and details in such as are Egyptian, and of these we had some fine specimens in the Egyptian department at the British Museum, and a charm was thrown around these relics when we considered we saw in them types of those precious works of art wrought by the hands of the favoured people of God. An objection might be raised, Would Moses copy works of art prostituted to the worship of idols, in constructing a service for Jehovah? In meeting this objection, Mr. Clements referred to a recent writer who had studied the source of Egyptian art, and whose conclusions were, that the art of Egypt was not *original* nor of *an Eastern Asiatic origin*, but from *Chaldea*, the seat of primeval man. The conclusion, therefore, was that though the Hebrew artists copied Egyptian types, those Egyptian types were derived from times and persons who employed them in primitive worship. They were not originated by idolaters, although prostituted by them in their worship. The Hebrews, as a nation, did not progress in art. "From the splendour of its beginning, we might have expected a glorious career," says an eloquent writer. Why should not the heroic forms of Judah's warriors, if sculptured by Jewish chisel, and the beauty of the daughters of Jerusalem, if delineated by native pencil, have just as far excelled the marbles of Phidias, or the paintings of Apelles, the statues of Michael Angelo, or the Madonna of Raphael, as the majesty of the Psalms and the sublimities of the Prophets surpass the lyrics of Pindar or the descriptions of Homer?" It is asked why? That they did not, is certain; and a disappointment is felt by the lovers of art and admirers of beauty. In a few centuries the genius of the nation died out. Solomon, in the erection of his Temple, was compelled to call in the aid of foreign artists; and subsequently, the genius of the nation rose no higher in art than what was necessary in the commonest handicraft trades. Two reasons may be assigned for this. In the Hebrew nation there was not that scope for artistic genius as in other nations. They were limited to certain selected patterns, beyond which the Hebrew artist was forbidden to go. This must have been highly detrimental to the progress of Jewish art. It was otherwise in Egypt, Greece, and Rome. New gods continually sprung up, and these called for new embodiments. New idols were conceived, and sought to be expressed in sculptured marble, or other forms of sculptured art: there was, therefore, a continued demand made on artistic genius, and abundant scope for its culture. Another serious drawback to the artistic genius of the Hebrew nation was its exclusiveness. Hebrew artists were not in a position to profit by the advancing skill of other nations, nor had they scope for any productions arising up in their own. The Hebrew nation, poor as it is in monuments of art, and deeply to be regretted as this circumstance is, we may congratulate ourselves that it is rich in Hebrew literature. No other nation has bequeathed to us writings so characterised by grandeur of thought and beauty of diction; so ancient in their date or so important in their subject. All other historians, poets, writers of every class sink into comparative insignificance in the presence of Moses and the Prophets, David, and the other Hebrew bards; and what gives them their highest value of all is, that they are able to make us wise unto salvation.—The performance of the Glee, "The Red Cross Knight," by Messrs. Portray, Sach, and Maskell, was loudly encored. Mr. Wiedmayer presided at the piano. The Rev. C. Burney then rose, and in a very appropriate speech, adverted to the benefits arising from such Institutions, and moved a vote of thanks to the gentlemen who had addressed them, and also to those who had enlivened the meeting by their excellent singing.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Chemical, 8.
Statistical, 8, Mr. Robert Hunt, "On the Present State of the Mining Industries of the United Kingdom."
Tues. Royal Inst., 3, Prof. Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Mr. G. P. Bidder, "On Mental Calculation."
Linnean, 8.
Pathological, 8.
Wed. Society of Arts, 8, Mr. Alexander Whytock, "Recent Improvements in Carpet Manufacture, their Use and Abuse; with a Word on Beauty and Deformity in Carpet Design."
Geological, 8, Mr. H. Poole, "Report of a Visit to the Dead Sea;" 2, Prof. Owen, "On the Affinities of the Large Extinct Bird (*Gastornis Parisiensis*) indicated by a Fossil Femur and Tibia discovered in the lowest tertiary, near Paris;" 3, Prof. Owen, "On some Mammalian Fossils from the Red Crag of Suffolk."
Thurs. Royal Institution, 3, Professor Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.
Fri. Philological, 8.
Royal Institution, 8½, Prof. Faraday, "On Magnetic Actions and Affections."
Sat. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 6th February, 1856.

Par. No.
6. Railway Acts—Return.
8. Bills—Burial Grounds (Ireland).
11. Bills—Juvenile Offenders (Ireland).
12. Bills—Police (Counties and Boroughs).
29. Bills—House of Commons' Offices.
Agricultural Statistics (Scotland)—Supplementary Report.

Delivered on 8th February, 1856.

13. Navy—Statement of Excess of Expenditure, 1854-55.
14. Transport Service and Prisoners of War—Estimate.
15. Post-Office Department (Packet Service)—Estimate.
16. Navy Estimates.
3. Bills—Formation, &c., of Parishes.
5. Bills—Episcopal and Capitular Estates.
9. Bills—Court of Chancery (Ireland) (Jurisdiction).
14. Bills—Court of Chancery (Ireland) (Appeals).

Delivered on 9th and 11th February, 1856.

6. Queen Anne's Bounty—Account.
7. Acts of Parliament—Return.
11. Bank of England—Annual Accounts, &c.
18. Civil Services (1855-56)—Supplemental Estimate.
12. Bills—Court of Chancery (Ireland) (Procedure).
13. Bills—Court of Chancery (Ireland) (Receivers).
15. Bills—Court of Chancery (Ireland) (Sales of Estates).
21. Bills—Church Rates.
22. Bills—Charitable Uses.
Turnpike Trusts (England and Wales)—General Report of the Secretary of State.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette February 8th*, 1856.]

Dated 15th November, 1855.

2577. George Lister, Leamington—A cooling apparatus to be used in brewing.

Dated 7th December, 1855.

2765. William Inlam Ellis, Salford—Improvements in the slide valve or valves of steam or other motive-power engines.

Dated 12th December, 1855.

2805. Robert W. Davis and Daniel Davis, Yellow Springs, Greene, Ohio—Improved vice.

Dated 15th December, 1855.

2836. George Coats, Glasgow—Improvements in horse shoes and in attaching the same to horses' feet.

Dated 28th December, 1855.

2935. Francis Preston, Manchester—Improvements in the construction of military small-arms.

Dated 3rd January, 1856.

19. James Bagster Lyall, Castle Frome, Hereford—Improvements in carriages.

Dated 9th January, 1856.

67. Frederick Albert Gatty, Accrington—Improvements in the manufacture of lake colours.
71. John Ashworth, junior, Turton, [Lancaster—Improvements in lap machines or apparatus used in the preparation of cotton and other fibrous substances for spinning.

Dated 10th January, 1856.

79. John Erskine, Glasgow—The application of a new material or mixture for dressing or sizeing textile fabrics or materials.

Dated 18th January, 1856.

133. Giuseppe Antonio Tremeschini, Vicence (Lombardo Venetian)—Improvements in electro-telegraphic communications.
135. Miguel de Bergue, Barcelona—Improvements in the permanent way of railways.
137. William Marshall, Smethwick—Improvements in rolling iron for the manufacture of gun barrels and tubes, and for other like purposes.
139. David Shaw, Gee Cross, Chester—Improvements in looms for weaving.
141. Nathaniel Shattswell Dodge, St. Paul's Churchyard—Improvements in treating vulcanized india-rubber or gutta-percha. (A communication.)
143. Jonathan Holden, Halifax—Improvements in machinery for cutting or carving and figuring wood.
145. Joseph Marzolo, Padua—"A reproductive organ," printing with known notes any musical fancies, and equally applicable to piano-fortes, melodiums, harmoniums, accordeons, and generally to all keyed musical instruments.

Dated 19th January, 1856.

147. Alfred Heaven and William Booth, Manchester—Improvements in machinery for embroidering fabrics.
149. Edward Pickering, Chatham-place, Blackfriars—Improvements in the permanent way of railways.
151. Isaac Barnes, Birmingham—Improvements in carriage lamps.
153. Frederick Ayckbourn, 10, Princes-street, Stamford-street—Improvements in the cleaning of knives and forks.
155. Charles Robertson, 68, Mark-lane—Improvements in mariner's compasses.

Dated 21st January, 1856.

159. James Pockson, Penton-street, Walworth—Improvements in the construction of roofing and other tiles.

Dated 22nd January, 1856.

163. Jean Baptiste Pierre Alfred Thierry, Junior, Jean Louis Richard, Paris, and Baron Henry de Martiny, Versailles—Improvements in preventing smoke by means of a fumivore hygienic apparatus.
165. John Gedge, 4, Wellington-street South, Strand—Improvements in bending, edging, and soldering tin. (A communication.)
167. Alexander Robertson, Upper Holloway—A new manufacture of cases or canisters for dry goods, edibles, and such like commodities.
169. Edward Lawson, Leeds, and George Jennings, Hunslet—Improvements in reeling machines for winding flax, cotton, and other yarns.
171. Joseph Francis, New York—Improvements in the manufacture of metallic boats.

173. Henry Elliott Hoole, Green Lane Works, Sheffield—Improvements in stove grates.

Dated 23rd January, 1856.

175. George Holcroft, Manchester, and James Peacock, Salford—Improvements in casings for fencing horizontal shafts.

177. Alexandre Tolhausen, 7, Duke street, Adelphi—Improved lock joint for the rails of railways. (A communication.)

179. Edward Lloyd, Dee Valley, near Corwen, Merionethshire—Improvements in valves, and in the valve-gear of locomotive and other steam-engines.

183. Isaac Barnes, Birmingham—Improvements in the manufacture of knobs and furniture for doors, drawers, and other similar purposes, parts of which improvements are also applicable to the manufacture of cornice poles and other like articles.

185. Stephen Norris, New Peter-street, Westminster—Improvements in the manufacture of boots and shoes and other coverings for the human feet.

Dated 24th January, 1856.

186. Louis Antoine Romain Richoux, Paris—Improvements in clock works.

187. Pierre Samain, Meusnes (Loire-et-Cher), France—Improved levelling instrument.

188. John Solomons and Edwin Lander, Birmingham—Improved cigar holder.

189. Charles Rothwell, Stalybridge—Improvements in self-acting mules.

190. John Strafford, Stratford—Improvements in portable signal lamps for railway, marine, and other purposes.

191. John and George Gimson, Staley Bridge—Improved apparatus applicable to steam pipes used for the purposes of heating and drying, which said apparatus may also be used for other similar purposes where steam is employed.

192. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in air beds, mattrasses, and cushions. (A communication.)

193. George Brooks Pettit and Henry Fly Smith, Oxford-street—Improvements in gas heating apparatus.

194. David Fisher, 12, Ranelagh-road, Thames-bank—Improvements in machinery for pressing, cutting, drying, and opening tobacco.

Dated 25th January, 1856.

196. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved machine for boring and other cutting operations in stone and other mineral substances of similar character. (A communication.)

198. Andrew Shanks, 6, Robert-street, Adelphi, and Francis Herbert Wenham, Effra Vale Lodge, Brixton—Improvements in water guages.

200. John Kershaw, Stockport—Improvements in apparatus for preventing the explosion of steam boilers.

202. Joseph Peak, Manchester—Improvements in machinery or apparatus for pointing and turning bolt-heads, facing nuts, centreing, drilling, and similar purposes.

204. Alexander Dalgety, 76, Florence-road, Deptford—Improvements in vices, or gripping or holding apparatus.

206. William Owen, Red Lion-square—Improvement in pianofortes.

Dated 26th January, 1856.

208. George Henry Ingall, Old Broad-street, and George Oscar Shaw Browne, Glasshouse-street, Nottingham—Improved method of railway signalling.

210. George Napier, Bath-street, Glasgow—Improvements in the construction and arrangement of the flues, air passages, and other parts of furnaces, and also in controlling the passage of smoke, and in heating and regulating the supply of air to facilitate combustion.

212. Edward Vincent Gardner, 24, Norfolk-street, Middlesex Hospital—Improvements in heating, drying, desiccating, and evaporating.

214. Jean Louis Ambroise Huillard, Paris—Improvements in the processes of singeing and dressing textile fabrics, and in apparatus for the same.

216. Samuel Statham, Islington—Improvements in electric telegraph conductors.

218. William Beasley, Smethwick—Improvements in machinery or apparatus to be employed in rifling the barrels of fire-arms and ordnance.

Dated 28th January, 1856.

222. John Wormald, Manchester—Improvements in machinery or apparatus for folding, "fenting," and making up goods or fabrics.

224. Augustin Magloire Jullienne, Herblay (Seine-et-Oise), France—Improvements in brakes for railway trains.

226. Pierre Samain, Meusnes (Loire-et-Cher), France—Improvements in tables, stools, and other pieces of household furniture.

228. Robert Barrow, 32, Garford-street, Poplar—An equilibrium slide valve for steam engines.

230. William Asbury, Birmingham—Improved tap or stop cock.

232. John Whitehead, Leeds—Improved machinery for fulling cloth. (A communication.)

Dated 29th January, 1856.

234. George Darlington, Minera, near Wrexham—Producing oxide of zinc from its ores.

236. Daniel Foxwell, Manchester—Improvements in sewing machines.

238. Robert Thatcher, Oldham—Improvements in preparing for doubling or spinning cotton or other fibrous substances.

240. Owen Murrell, Bethnal Green-road—Improvements in swing looking glasses.

242. Henry Chance, Birmingham—Improvement in the manufacture of moulded articles when using vitreous materials.

244. Joseph Fowell Walton, Sarratt-hall, Rickmansworth, and Honore Le François, Lambeth—Improvements in cleaning forks, spoons, stewpans, and other culinary utensils.

246. Auguste Mathieu Maurice de Bergevin, 27, Rue Labat, Montmartre, Paris—Improvements in preparing coal for burning, and in the furnaces employed in consuming such coal.

WEEKLY LIST OF PATENTS SEALED.

Sealed February 8th, 1856.

1792. Benjamin Williamson Pycock.
1806. Thomas Sleight.
1814. Edward Finch.
1815. Edward Finch.
1823. Thomas Hewitt.
1829. Alexander Cameron Morrison.
1830. Edmund Topham.
1832. William John Gregory.
1836. Robert Blackburn and William Lundi Duncan.
1868. Jean Jacques Danduran.
1870. David Brown and Jeremiah Brown.
1882. Francis Journeaux.
1833. William Soelman.
1907. Victor Fouchier.
1937. Emile Constantin Fritz Sautelet.
2063. Francis Gybbon Spilsbury and Frederick William Emerson.
2072. Jules Albert Hartmann.
2201. George Tomlinson Bousfield.
2249. Perceval Moses Parsons.
2436. Richard Reeves Cox.
2444. Lewis Normandy.
2538. William Kemble Hall.
2542. John Yuil Borland.
2565. Joseph Robinson.
2568. George Tomlinson Bousfield.
2728. Jean Davoust.
2747. Ebenezer Poulson.
2808. George Heron Hay and David Syme Hay.
2835. Ebenezer Rogers.

Sealed February 12th, 1856.

1833. Walter Hancock.
1838. Albert Thornton and Frederick Thornton.
1842. George Shears.
1864. William Fawcett and Francis Best Fawcett.
1866. William Maynes.
1939. Samuel Ludbrook.
1964. Paul Eugène Charton.
2006. James Henry Bull.
2120. John Palmer.
2154. Matthew Atkinson and Benjamin Ridge, M.D.
2558. William Foster.
2646. Samuel Cunliffe Lister and James Warburton.
2664. James Clark.
2667. William Edward Newton.
2669. Hiram Hyde.
2706. Samuel Cunliffe Lister.
2802. Alexandre Forot.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

February 5th.

412. William Bridges Adams.
472. Thomas Browne Jordan.

February 6th.

335. Auguste Edouard Loradoux Bellford.

February 7th.

344. Richard Archibald Brooman.
545. Robert Craib Ross.

February 8th.

360. George Hutchinson.

February 9th.

374. George Henry Bursill.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3800	February 7.	Improved Sash Frame Guide Pulley......	Thomas and Charles Clark.	Wolverhampton.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 22, 1856.

EXAMINATIONS FOR CANDIDATES FROM INSTITUTIONS ASSOCIATED WITH THE SOCIETY OF ARTS.

The Examinations will commence on Monday the 9th of June, 1856, at the Society's House in the Adelphi.

Candidates who propose to offer themselves for Examination, must give written notice of their intention to the Secretary before the 31st of May, 1856.

All Candidates will be required to possess a competent knowledge of Writing and Spelling.

Every Candidate will be expected to come prepared in two subjects (not subdivisions of subjects) at least.

The Examiners in *Science* merely recommend the text-books set down: they will be prepared to recognise knowledge however obtained.

The Examination will be conducted by written papers and by oral examination.

The Examiners will award Certificates of Three Classes.

First Class Certificates will be awarded only to a high degree of excellence.

The *Stephenson Prize* of Ten Guineas will be awarded to the Candidate who shall pass the best examination in Mathematics and Mechanics, and obtain a First Class Certificate in each.

Mr. C. Wentworth Dilke, Vice-President of the Society, gives a prize of Ten Guineas, to be awarded to the Candidate who shall pass the best examination in English History, and obtain a First Class Certificate.

Mr. G. N. Hooper gives a prize of Ten Guineas to the Candidate who shall pass the best examination in French, and obtain a First Class Certificate.

NAMES OF THE EXAMINERS.	SUBJECTS.	SUBDIVISIONS.	TEXT BOOKS AND LIMITS.
Rev. Dr. Booth, F.R.S. Mr. Glaisher, F.R.S.	Mathematics	Arithmetic Algebra Euclid Mensuration	Colenso's Arithmetic, to end of Decimal Fractions. Colenso's Algebra, to end of Quadratic Equations. Euclid, books I. II. III., Simson or Potts. Tate's Mensuration.
Mr. C. Brooke, F.R.S. Mr.	Mechanics	Statics. Principles of Mechanism, & their Application to simple Machines, to the Steam Engine, &c.	Galbraith and Haughton's Manual of Mechanics. Bird and Brooke's Elements of Physics.
Professor Solly, F.R.S. Dr. Stenhouse, F.R.S.	Chemistry	Organic and Inorganic	Wilson's Chemistry. Chambers' Educational Course. Fownes' Manual of Chemistry.
Dr. W. B. Carpenter, F.R.S. Dr. Bence Jones, F.R.S.	Physiology		Carpenter's Manual (*Churchill*). Coombe's Physiology.
Dr. Carpenter, F.R.S. Professor Henfrey, F.R.S.	Botany	General Structure Systematic Botany	Lindley's School Botany. Henfrey's Rudiments of Botany.
Rev. Dr. Booth, F.R.S. Rev. S. Clark Dean of Hereford	Geography	Political Physical	Milner's Geography (*Tract Society*). Guyot's Earth and Man (*Parker's Edition*).
Professor Brewer Rev. F. Temple	English History		Ince's Outlines of English History. A more extensive knowledge of the following reigns: Alfred, William I., John, Henry VIII., Elizabeth, and the Stuarts to the end of the reign of Anne.
Professor Brewer Rev. Dr. Elder Rev. W. Elliott Rev. F. Temple	English Literature and English Composition		Bromby's English Grammar. Chaucer's Prologue to the Canterbury Tales. Spenser's Fairy Queen (first book). Shakspeare, King John, Henry IV., Henry V., Lear, Hamlet, Macbeth, Othello. Bacon, first book of the Novum Organum; the Preface; fifth and seventh books of the Advancement of Learning. Milton's Paradise Lost. Dryden. Virgil's Æneid, six books. Spectator. Pope's Poetical Works. Butler's Analogy. Wordsworth's Excursion, or Lyrical Ballads. Tennyson. *Candidates may take up any two authors of the above.*
Professor Browne Mr. Sandford	Latin	Roman History	Sallust, Jugurthine War. Cæsar, first book. To end of Punic Wars, or from that date to the death of Augustus Cæsar. Dawson Turner's Outlines of Roman History.
Mr. Brasseur	French		
Dr. Bernays	German		Trene bis in den Tod, by G. Nieritz. Schiller's Jungfrau von Orleans.

Should the proposed Examinations receive the approbation and support of those classes for whose benefit they are undertaken, namely, employers and candidates for employment, the Council of the Society of Arts will be prepared to take into their consideration the propriety of holding Annual Examinations at several convenient places throughout the country.

By order,
P. LE NEVE FOSTER, *Secretary*.

Society's House, Adelphi, London, Feb. 20, 1856.

TENTH ORDINARY MEETING.

Wednesday, February 20, 1856.

The Tenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 20th inst. Peter Graham, Esq., in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Corsellis, Arthur Alexander
Hopkinson, Jonathan
Leonard, James
Marryatt, Joseph
Ransome, James Allen
Smith, Samuel
Wright, Charles Edmund

The following Institution has been taken into Union since the last announcement:—

410. Wakefield, Mechanics' Institution.

The paper read was

RECENT IMPROVEMENTS IN CARPET MANUFACTURE, THEIR USE AND ABUSE; WITH A WORD ON BEAUTY AND DEFORMITY IN CARPET DESIGN.

By Alexander Whytock.

The annals of weaving are dull; historians have deemed it more worthy their labour to chronicle the glory of kings, or, with their father, Herodotus, "to rescue from oblivion the great and wondrous deeds displayed; both by Greeks and barbarians, and amongst the rest for what cause they waged desperate and bloody war upon each other," than to describe the useful arts which flourished in time of peace. Hence, we are without sufficient data to rear any goodly historical structure from the remnants of antiquity. It is our intention, nevertheless, to essay a sketch, critical and historical it may be, of the carpet manufacture; to trace it through its various phases of development; to record its later and more notable improvements, and to observe the influence of a mistaken economy upon its present condition. We shall also endeavour to investigate the present state of feeling as to the nature of carpet design, with a view to its better understanding,

The strict application, in our day, of the term *carpet*, does not render illegitimate the use of the term in a wider sense, in discoursing upon its original intendment. For here let it be premised, that the carpets and tapestry of ancient and mediæval times cannot be separately treated; the frequent transposition of the terms, and the variety of the purposes to which these articles were mutually applied, quite frustrating such a distinction.

To the process of manufacture, presently extant, we shall hereafter allude. Concerning the process among the ancients, we have no precise information, as indeed none is required, the weaving of carpets and tapestry being then a slow work of the needle, for the delicate hands of a Helen or Penelope. Of Helen it is somewhat sagaciously remarked, by Athenaeus, that her fondness for this employment proved her temperance and modesty. King Lemuel, also, in setting forth the character of the virtuous woman, says, "she maketh herself coverings of tapestry." It was an ancient Chaldean gossip that Sardanapalus, attired in female garb, was wont to card purple wool for his concubines, who wrought carpets for the royal household. In Greece, however, the carding of wool was the more usual occupation of slaves, as in the Statesman of Plato, where elaborate analyses of the arts of weaving and felting are given. According to Pliny, the thick flocky wool has been esteemed for the manufacture of carpets from the remotest ages. Early allusion to the shuttle is made, in connexion with this art, and it appears to have been used alternately in the same web with the embroidering needle, if not identical therewith. The several parts of the loom apparatus in active operation, are mentioned by Ovid:—"The web is tied around the beam; the sley separates the warp; the woof is inserted in the middle with sharp shuttles, which the fingers hurry along, and being drawn within the warp, the teeth notched in the moving sley strike it." But whether this poet be guilty of anachronism in placing a box-wood shuttle in the hands of Minerva we cannot determine. From his description, she was challenged by Arachne, a Colophonian woman, who was very expert in weaving tapestry, to a trial of skill. Her father, Idmon, used to dye the soaking wool in Phocæan purple, and her son, Closter, was the accredited inventor of the spindle. Such was the magnificence of her embroideries, and so graceful her manner of working, that the nymphs hovered around her loom to admire. Minerva accepted the challenge, but the result yielded a doubtful victory, whereat the goddess was duly incensed, and a scuffle ensuing, Arachne hanged herself and was transformed into a spider. The story of Minerva's vengeance is thus recorded:—

> "A great fly shuttle in her hand she took,
> And more than once, Arachne's forehead struck;
> The unhappy maid, impatient of the wrong,
> Her injured person from the breast beam hung."

The Babylonians and Parthians were famous for embroidering carpets in different colours; so also were the Gauls, but we are informed by Pliny that they differed in the manner of working. Carthage, Sardis, Phœnice, and Alexandria, among other cities, were celebrated for this manufacture. Some were made having the woolly nap on both sides, but more commonly on one. They were occasionally varied with threads of silk and gold. Among those who are said to have excelled in the manufacture, the names of Pathymias the Egyptian, with Acesas and Helicon of Cyprus, are handed down. Müller conjectures that the two latter exercised their handicraft under the direction of Phidias the sculptor, in the age of Pericles.

Of carpets without certain modifications of colour and pattern, we have, properly speaking, but slight record in antiquity, and none in modern times. We find the carpets of the ancients to have been for the most part beautifully coloured and inwrought with various figures. The carpets of Babylon were particularly extravagant, having representations of animals, both natural and fabulous, embroidered on them. Egypt emblazoned her rugs with hieroglyphs and portraits of her kings, and her tapestries were bespangled with the constellations of heaven, and the twelve signs of the Zodiac. Plantus notices the Alexandrine tapestries to have been figured over with beasts and shells. Sophron, too, speaks of carpets embroidered with figures of birds as of great value; and it was in Gaul they were first made with chequers or tartans. Entire histories, and stories from mythology, were woven in carpets. Homer discovers Helen herself weaving the Trojan wars. Catullus makes mention of carpets used to decorate the wedding feast of Peleus, representing, with wondrous art, the story of Theseus and Ariadne. And Ovid presents Arachne, depicting in the designs of her tapestry, the amours of Jupiter with Europa, Antiopa, Leda, Asteria, Danae, and Alcmene; the extreme part of the web, being enclosed in a fine border, had flowers interwoven with the twining ivy. The embroidering of flowers upon carpets originated with the practice of strewing chaplets over the ground, to which frequent reference is made. Dionysius of Syracuse caused his servants to strew wild thyme and roses on the floor of his banqueting-room, "so as really to give the appearance of a most divine meadow," as we are told.

It was a very usual custom among the Greeks, evidently borrowed from the East, to place a carpet upon the couch, and to spread a carpet beneath; thus we read in Plato, "men now distinguish the couches and carpets with an eye to what is put round the couch, and what is placed below." So also in the Odyssey; "the white armed Arete commands her handmaidens, having placed couches in the portico for the much-enduring divine Ulysses, to throw upon them beautiful purple rugs, and to strew tapestry beneath." The couch of Telemachus was arranged after the same fashion, and the dog of Procris, probably in burlesque of Homer's description, was tended in a similar manner:—

> "Strew then soft carpets underneath the dog,
> And place beneath cloths of Milesian wool,
> And put above them all a purple rug."

In the Æneid, Rhamnes is slain while "raised high on lofty carpets, snoring forth sleep from his whole breast," and his rich trappings and beautiful carpets are carried off as a booty by Euryalus.

As an instance of the effeminacy of the Medes, Athenaeus relates—"It is not enough for them to have their beds softly spread, but they put even the feet of their couches upon carpets, in order that the floor may not present resistance to them, but that the carpets may yield to their pressure." When Alexander took Darius prisoner, he celebrated a marriage feast in an apartment covered with cloths of purple and scarlet and gold, and one of Alexander's companions, Cleitus, surnamed the White, "whenever he was about to transact business, used to converse with every one who came to him while walking about on a purple carpet." In the Agammemnon of Aeschylus, we have an illustration of this custom of spreading carpets on the ground. Clytemnestra will not permit Agammemnon, on his return from Troy, to plant the foot which trod down Ilion on the bare ground. "Maidens! why do ye delay," she says, "on whom hath been imposed the task of strewing the surface of the way with tapestry? Let a purple-strewn path be made forthwith." Against which Agammemnon expostulates—"Make not my path obnoxious to the evil eye by strewing it with vestments. With these, indeed, it is fitting to honour the gods, but for one that is a mortal, to walk on embroidered purple, is for me by no means free from dread. Without carpetings and gay fineries, my fame speaks clearly forth." He is, however, eventually persuaded to "trample in these sea-grained vestments and tissues bought with silver," but not until his sandals are loosed from his feet. Purple carpets were greatly sought after by the wealthy patricians of Rome. Metullus Scipio, in the accusation which he brought against Càto, stated, that even in his time, Babylonian covers for couches were selling for 800,000 sesterces (or £4,600), and these, in the time of the Emperor Nero, had risen to four millions (or £23,000.) Lollia Paulina, the great beauty of Rome, in the time of Caligula, rendered herself notorious by the enormous prices given for her rich Babylonian carpets and coverlets. The names of Crassus and Clodius are likewise handed down to us by Pliny, as having squandered vast sums upon these goods. P. Lentulus Spinther, who was curule aedile in the consulship of Cicero, was the first who wore the praetexta robe, twice dipped in Tyrian purple, and he was severely censured for it. "Whereas nowadays," writes Cornelius Nepos, "who is there that does not have purple hangings even to his banqueting couch." A detailed account of the ancient Tyrian dye—the "purple blood" of Homer—prepared from the murex, also of the colour made from kermes, may be found in the IX. Book of Pliny's Natural History.

In these classic times, carpets were displayed on great occasions of pomp and ceremony, and at funereal and triumphal processions. They were also the many-coloured trappings of elephants and horses. Of such nature were the Phalara of Agesilaus, painted as Ephesus, and of Rhesus's horses in Euripides. Similar were the Trojan housings of Virgil, and those wherewith the golden ass of Apuleuis was caparisoned. We have also notice of carpets being the decorations of tombs and cenotaphs. In Arrian's Expedition of Alexander, we read that, "on the golden coffin of Cyrus, son of Cambyses, was placed a covering of Babylonian tapestry, and carpets underneath, of the finest wrought purple." Correspondent whereunto was the burial of steed-breaking Hector, whose ashes being placed in a golden urn, were covered with purple cloths. Such also was the practice in the East at later periods, as in the Arabian tale of "Ganem the son of Ayoub," where reference is made to this custom of spreading carpets around the tombs.

During the earlier periods of the Moslem sway, when the Eastern muse, albeit pagan enough, was better cultivated, we are favoured with repeated illustrations of the use of carpets and tapestry. The casside of Amralkeise, an Arabian poet, gives us to understand that the colours of the earth are varied, like the tapestry of the kings of Ormuz—a retrogressive comparison. We read also of dwellings furnished with variegated carpets, and gardens hung with tapestry. The manner of using carpets presents little variation in the different quarters of Asia. We may quote the words of Henry Maundrell, who wrote in 1697, as equally descriptive of their use in all parts of the East in former and later times. When at Tripoli he entered some of the Turkish divans; "they are spread," he observes, "with carpets, and furnished all round with bolsters for leaning upon. Upon these the Turks eat, sleep, smoke, receive visits, say their prayers, &c. Their whole delight is in lolling upon them; and in furnishing them richly out is their greatest luxury." This corresponds with the most ancient usage, as well as with the well-known practice in the present day. Accordingly, it is not necessary to give another account, almost precisely the same, from the letters of Lady Mary W. Montague.

The Eastern nations have at all times maintained the well acquired celebrity of their carpet manufacture. In India, where it may be said to have originated, it has survived during many ages, and still continues much as heretofore. In Persia, carpet weaving is the occupation of distinct families and tribes, a knowledge of whose handicraft is entailed from father to son. Sir John McNeil, late British Ambassador at the Court of Persia, brought home an unfinished carpet, which was in progress of manufacture, when the whole family of weavers engaged upon it were totally extirpated by the hands of a hostile tribe.

The manner of manufacture we may safely infer to have been, in former periods, very near akin to what it now is. The simple process of knotting woollen tufts upon cotton or other warp, and crossing each row with a weft shoot, requires no description. On this method the carpets of Mirzapore, Jubbulpore, and Masulipatam, in India, as of other places in Persia and Turkey are produced. Many of the finer carpets of this country, France, and Belgium, are so wrought. The weaving of tapestry has also travelled westward from Asia, but with this difference that it has left no such manufacture behind, if we except the shawls of Cashmere, and other embroideries of a similar nature. The embroidered carpets of Scinde, especially of Hydrabad, are celebrated throughout India. These display a combination of gold, silver, and silk threads, tamboured upon cloth or canvas. When the worker is familiar with a pattern, he proceeds with great swiftness, and no little precision; but when a new design is submitted to him, he first traces it upon the cloth. This is done by perforating the sketch with a needle, thereby indicating its outline upon a sheet of paper, whence it is transferred to the cloth by washing over the holes with white paste. The same mode is practised in making the carpets of Mooltan and Tanjore. Such embroidered carpets have not yet been introduced into this country; the only Indian carpets in general use here being those of Masulipatam.

It would be idle to enumerate the names of the eastern cities where the carpet manufacture has been or is carried on. When Baldach or Bagdad was visited by Marco Polo, about 1255, there was "there a manufacture of silks, wrought with gold, and also of damasks, as well as carpets of velvet (*velluti vel tapeti*) ornamented with figures of birds and beasts." But "the best and handsomest carpets in the world," he says, "are wrought in Turcomania." Bertrandon de la Brocquière, a French traveller, who visited Gallipoli, in 1432, notes that it was there he first saw Turkish carpets made. At the bazaars of the principal cities, these goods are bought from the weavers, and afterwards purchased by merchants, who convey them to distant markets. Bagdad was long the rendezvous of carpet traders, and through it, during many years, flowed much of the wealth and merchandise of India. Constantinople at a later day became the central emporium for these and all other eastern goods. Benjamin, of Tudela, in the year 1161, describes "the great stir and business which prevails at Constantinople, in consequence," he says, "of the conflux of many merchants who resort thither both by land and sea from all parts of the world, for purposes of trade; including merchants from Babylon and from Mesopotamia, from Media and Persia, from Egypt and Palestine, as well as from Russia, Hungary, and Patzinakia, Budia, Lombardy, and Spain." About three centuries later, De la Brocquière informs us that, "of all the merchants who come to this city, none are so powerful as the Venetians, who have a bailiff to regulate all their affairs, independent of the emperor and his officers." They enjoyed many privileges in consequence of their share in the conquest of the East by the Latins, in 1204, but were deprived of them through the machinations of the Genoese, who assisted in establishing the Greek power at Constantinople, and engrossed the entire European traffic in this quarter, until the ascendancy of the Turks, in 1453, when they were compelled to abandon it. The Venetian traders having been driven to Alexandria, for the produce and manufactures of the East, preserved this market against the Genoese, whose commerce thenceforward declined. The Florentines, however, shared the commercial intercourse with Alexandria, and carried on a large import trade with England, so that with the commencement of the fifteenth century, this country first received regular supplies of eastern merchandise. For, although carpets were introduced so early as the Crusades, they were not yet articles of English commerce. Even in the sixteenth century we meet with few, the Norman practice of spreading rushes on the floor being then generally prevalent. Perlin, a French physician, who visited England in the reign of Edward VI., relates of the London tavern-keepers, that "they strew hay over the floor and place pillows and tapestries underneath their travellers. And Laevinius Lemnius, about the same time, remarks, "the pavements are sprinkled upon, and floors cooled with springing water, and then strewed with sedge, and the parlours trimmed up with greene boughes, freshe herbes and vyne leaves—which things no nation do more decently more trymmely nor more sightly than they do in England; and besyde this, the neate cleanliness, the pleasaunte and delightful furniture in every point of household, wonderfully rejoyced mee." We get a very different account of the same custom in a letter of Erasmus to Franciscus, physician to Cardinal Wolsey, where he ascribes the plague and sweating sickness, then prevalent in England, to the filth and slovenliness of this usage. "The floors," he writes, "are commonly of clay strewed with rushes, under which lies unmolested a putrid mixture of beer, stinking fragments of food, and all sorts of nastiness." In connexion with this, it may not be uninteresting to quote a further illustration from an incident occurring when Erasmus was at the dinner table of Sir Thomas More:—"A while after," narrates his daughter Margaret, "Gonellus asked leave to see Erasmus his signet ring, which he handed down to him. In passing it back, William, who was occupied in carving a crane, handed it soe negligentlie that it felle to the ground. I never saw such a face as Erasmus made when 'twas picked out from the rushes! And yet ours are renewed almost daylie which manie think over-nice. He took it gingerlie in his faire womanlike hands, and washed and wiped it before he put it on, which escaped not my stepmother's displeased notice." Carpets of painted and gilt leather were used about this time, but more as coverlets for beds, cupboards, and tables, than for the floor, Turkey carpets were esteemed among the treasures of the rich. On the Continent of Europe they were more extensively used; indeed, a Venetian merchant or his customer in Bruges, Augsburg, or Antwerp, could make a more magnificent display of the wealth of the Orient than could our Monarch Henry VIII. While on the other hand, ladies of good estate in this kingdom, plied the needle with much assiduity, it being considered a mark of high breeding to excel in weaving embroideries of tapestry. Nor was this badge of ladyhood a mere latter-day proverb. The early metrical romances furnish manifold corroboration of its weight in the days of old. Indeed, the word "wife" is itself derived from this occupation. The time when this manufacture was introduced into Europe is uncertain; but, even in the cold north, it has an ancient history. We read in Laxdaela Saga of Olafs banqueting hall at the marriage of Geirmund and Thorgeda being hung with tapestry representing the story of Baldur and the prowess of Thor. A fragment of a poem on this tapestry, composed by Ulf Uggison, has been preserved in the Skalda. The Flemings were at one time famous for their skill in this art, but France was the first European nation which carried it to perfection. The celebrated Bayeux tapestry belongs to the eleventh century. An interesting treatise on this ancient piece of needlework has lately been published by Dr. Collingwood Bruce. The tapestry of Nancy, known as "Dinner, Supper, and Banquet," was taken from the tent of Charles le Téméraire, after the seige of Lorraine, in 1477. We refer to the work of M. Achille Jubinal, on ancient Historical Tapestries, for specimens of designs embodied in those fabrics. About the beginning of its English history, we find an item in the wardrobe of Edward IV, "Arras, contg. ye story of Parys and Eleyn, with ymagery of silk." In the reign of Queen Elizabeth, Harrison writes, "the walls of our houses on the inner sides be either hanged with tapestry arras-work or painted clothe, wherein either divers histories or herbs, beasts, knots [of ribbon], and such like, are stained." Of such fantastic illuminated textures, Rabelais furnishes an amusing description. In his "Pantagruel," we are introduced to the country of tapestry; "its trees and herbage," he says, "never lose their leaves or flowers, and are all damasks and flowered velvet." "There we saw many beasts and birds, of the same colour, bigness, and shape, as those in our country, with this difference however, that these did eat nothing, and never sung or bit like ours; and we also saw there many sorts of creatures which we had never seen before." He goes on to say that he went to pluck some myrobolans off a piece of tapestry, whereon they hung, "but the devil abit," he adds, could I chew or swallow them; and had you had them betwixt your teeth, you would have sworn they had been thrown silk, there was no manner of savour in them." Specimens of tapestries of all epochs, arranged in chronologocal order, are to be found in the museum of the Louvre; and many village churches in the south of France contain ancient religious pieces of no small merit.

The first tapestry manufactory in France, of which we have any authentic record, was that established by an edict of the Castle of Paris, 1295. Henry IV. also brought weavers from Flanders to carry on this manufacture in Paris. The towns of Poictiers and Arras, in the 13th century, likewise contained large manufactories, but these are now no more, and the most ancient still in existence is the national manufactory of Gobelin. Louis XIV. purchased the building then known as *la follie Gobelin* for the purpose of its establishment. It was here that the Brothers Gobelin, decendants of the Secretary to Pope Pius II., exercised their craft of dyeing, a knowledge of which they were said to have borrowed from the evil one. Other three manufactories arose shortly afterwards; one at Aubusson, another at Felletin, and a third at Beauvois. To this day they continue their ingenious but arduous work, which, partly owing to low price of labour, but mainly in consequence of Government encouragement, is no inconsiderable manufacture. Efforts towards its introduction on a similar extensive scale into this country, have been so many failures, attributable to various causes. King James I. established a manufactory at Mortlake, in

Surrey, under the superintendence of Sir Francis Crane. It was here that King Charles II. afterwards caused Raphael's cartoons to be executed in tapestry. These cartoons, designed at the command of Pope Leo X., were sent to be copied at Paris, but were never returned to Rome, his holiness only receiving the copies in tapestry, for which he paid upwards of 400,000 francs. Of the originals, Charles I. bought several on the recommendation of Rubens, which subsequently fell into possession of Oliver Cromwell, but eventually found a place in the gallery of Hampton Court. With the name of Raphael, we may in passing, associate those of Julius Romanius, of Lebrun, Le Soeur, Coypel, David, and others, as artists who have designed for tapestries. The cartoons of Julius Romanius were wrought in tapestry at Brussels, sometime in greater repute for those fabrics than Paris. Glancing at other European States, we observe that Spain once attained a temporary notoriety in this manufacture, that in some parts of Italy and Germany it has been attempted, and that Russia commenced to cultivate the art about seventy years ago.

Considering the process of fabrication in itself, we fail to arrive at the conclusion that it displays much mechanical skill. Howsoever it may have been honoured as the medium of representing some of the finest works of art, it is but a slow and unscientific manipulation. The clearest definition of it would approximate very closely to the darning of a stocking, and whether this be done in a vertical or horizontal position, the result shows little difference. Notwithstanding, the perpendicular or high warp, as it is called, seems the more especially adapted to the correct copying of the design, as it enables the workman to see more justly the effect of his piece. This merely mechanical functionary, however, deserves but small credit for artistic skill—the main portion of the honour falling to him who transfers to the *mise en carte*, or design paper, a copy of the painting which is to be reproduced. Nor is he upon whom devolves the selection of the dyed yarns, and their arrangement for using in the loom, devoid of a share of merit. The more magnificent specimens of this tapestry are intended for the walls of the palace and the castle, while those of a larger warp and coarser material, such as are made at Aubusson, find a more general use on the floor. A large amount of artistic beauty usually pervades the character of those carpet designs, while it must be confessed that the *prestige* of the word "tapestry" goes far to excuse many designs having no pretensions to good taste; and to the undiscriminating their poverty is amply outweighed by their illustrious connexion.

Carpets on the principle of those of Persia and Turkey, with a tufted pile, are now commonly made in Europe. In France they have attained considerable excellence under the style of Savonnerie. Originally confined to Paris, they are now manufactured in Amiens, Turcoing, Nismes, and other places. England has also produced some of the best specimens. The Society of Arts was among the first to encourage the introduction of this manufacture. Very shortly after its institution, it offered premiums for the best imitation Turkey carpets, and thus directed considerable attention to the matter. The Duke of Cumberland, about the same time, lent his patronage to a manufactory of such carpets; and in the year 1755, Mr. Whitty introduced the manufacture into Axminster, whence the fabric derives its name. The Axminster carpet is now a matter of history, as it ceased to be fabricated there several years ago. At Wilton, however, the Messrs. Blackmore do well sustain the character of this manufacture, the superiority of their productions entitling them to the highest credit. Mr. Henry Blackmore has it, that Wilton claims the first introduction of carpet-weaving into England, and has kindly favoured us with the legend concerning it. It seems that one of the Earls of Pembroke, desirous of improving the condition of a small class of weavers in Wilton, induced a skilful French carpet weaver, named Anthony Daffony, to be smuggled over from France in a sugar-cask, for the purpose of communicating a knowledge of his handicraft, which he did. Within the last fifty years we observe a very great advance in the fabrication of the Anglo-Persian carpets; nor must we omit commendably to notice the Scoto-Persian carpets of Messrs. Gregory, Thomsons and Co. of Kilmarnock, and of Messrs. Richard Whytock and Co., of Edinburgh. This is now a national manufacture of no small amount, although the introduction of other fabrics has operated against a more extended use, and limited the product to a smaller, and perhaps a more select demand.

Hitherto, of the tardy hand-working, and here it is necessary to make a distinction between the hand-wrought or needle-wrought fabric, and that which is the result of mechanical appliance. The former is certainly of more ancient standing, but not the less fallible, while it is necessarily limited. The latter, comparatively of modern date, may be said to have out-manufactured all the productions of the years foregone. The first machine-wrought carpets which we have to notice are of a lower class, being made in the manner and belonging to the variety of what are now termed superfine, Kidderminster, Scotch, or ingrain carpeting. When and where such originated, we cannot surely ascertain, nor is it needful to know. We shall not arrogate to this country the claim or title of the first producer, but we may safely hazard the statement that here and in America the manufacture is principally followed. To practical men an explanation of the process were unserviceable, but in the estimation of others more or less concerned, a slight indication may be desiderated. The texture consists of two webs woven together at one operation, which by intersecting each other produce the pattern. Warp and weft must both be striped where more than two colours are introduced, and a striped effect being held objectionable, confines this manufacture to the use of two colours, in order to produce a plain or solid figure. As to pattern, it is now mostly the result of the Jacquard, although in other days the drawboy performed the part of this apparatus. And of late the weaver himself has been superseded by the action of the power-loom. In this respect, we must allow that the Americans have outstripped us, while they continue to buy the produce of the English hand-loom. At the Lowell Carpet Factory, on the Merrimack, U.S., there are upwards of 200 power-looms at work on this kind of carpeting. We have failed in our endeavours to ascertain the number of in-grain handlooms in England and Scotland, but it cannot be far short of 2,000.

The three-ply carpet explains its own condition; it is simply different from the in-grain by being composed of three distinct webs, instead of two, and having the advantage of a third solid colour in the figure. To Mr. Thomas Morton, of Kilmarnock, we owe the invention of this triple carpet fabric. This ingenious mechanist, among many improvements, also introduced the revolving barrel studded with pins, to act instead of the drawboy, in regulating the pattern. Before the introduction into this country of the Jacquard apparatus, this proved very serviceable, but it is now thrown aside. The Venetian and Dutch carpetings, as they are called, are of a simple character, and of less capacity for design. The Venetian consists mainly of a heavy weft-shoot, and is a weighty but soft material. In small diced patterns alone does it look well. The Dutch, originally a cow-hair texture, is now made of the lower qualities of wool; it is also a single web, and admits of nothing beyond stripes and chequers in its design. We need not observe that these fabrics have little connexion with the places whence they derive their name.

In treating of the Brussels carpet, we revert to the capital of Belgium to find little trace of such a manufacture there, although its name corresponds to the place of its origin. It is, perhaps, a fabric more thoroughly English in its present manufacture than of any other country. About the year 1735, we find the town of Kidderminster, hitherto famous for broad cloth, becoming the nursery of the English Brussels carpet. The progress of the manufacture in this town has been slow but steady, and after the lapse of a hundred years, we find it, in 1838, containing about 1765 Brussels hand-looms, besides a smaller proportion of ingrains and common qualities, giving employment to upwards of 4000 hands. That was eighteen years ago, and since then the introduction of the power-looms have caused many hand-frames to cease, and matters being thus in a transition state, there is difficulty in fairly computing statistics. A manufacturer may have so many hundred looms, a considerable portion of which may be held in abeyance while he is introducing power. In 1851, there were upwards of 2000 Brussels hand-looms in Kidderminster, besides many in Halifax, Durham, Kilmarnock, and districts in the north of England, and south of Scotland.

The peculiar beauty of the raised pile in the Brussels carpet will, we conceive, never lack its due appreciation. It has a corded appearance without a cord; and the elasticity of the worsted yarn—we speak of good qualities—imparts to the fabric a soft but substantial character. We need not here minutely detail all the intricacies of the manufacture. The weaver draws his worsted warp from several large frames, generally five in number, occasionally more or less, on each of which are placed 260 bobbins of a self colour for the ordinary width.* To produce the pattern, which is now effected by Jacquard, only one-fifth part of the five-frame warp appears on the surface; each frame interchanging its self colour threads as the pattern demands. By passing the worsted warp yarn over a wire, and then fixing it by weft-shoot, and afterwards withdrawing the wire, the corded appearance is produced. By introducing a grooved wire, the Moquette, Wilton, or Tournai carpet is made; the wire being released by a knife passing along its groove, and cutting open the yarn into a velvet pile. As bearing upon this manufacture, the invention of Mr. Richard Whytock, of Edinburgh, which has preserved all the proper characteristics of the Brussels and Wilton carpet, with a greater economy, demands consideration; and here we cannot construe a better description of both fabrics, nor furnish a better abstract of their comparative merits than by quoting the words of the distinguished geologist, Hugh Miller. The study of the earth's strata has afforded him a keen insight into the relative position of layers of threads in these textures. "Every one must have observed, in the structure of the common Brussels carpet a very great waste of materials. Suppose the pattern rich—the colours numerous—that groups of mimic flowers cluster in the gaily-framed compartments, or run in festoons along the squares, and that fantastic compound figures, which represent only themselves, blend with their usual accompaniments of fruit, flowers, and foliage. Each one of the colours employed, though employed in but the shading of a leaf, or of a petal, must yet be formed by continuously-coloured thread, running from end to end of the carpet. Every dot of colour has thus its continuous layer of thread, that, extending the whole length of the web, rises to the sight at intervals, to perform its part in the pattern, and then, sinking into the body of the fabric, serves but to add there to its expense and bulk. A single Brussels carpet may be thus regarded as a series of carpets laid wastefully over one another, with this disadvantage, too, that when the upper carpet wears out, all the others become useless. How remedy this defect by producing, with a single layer of coloured thread, the effect of many layers, retaining, meanwhile, every peculiarity of the rich Brussels fabric? How make *one* carpet serve for the many carpets wrought up together in the ordinary way? The question must have been often asked; and the well-known mode of printing calicoes must have often suggested an answer. But the plan of stamping, instead of weaving, could never be brought to succeed. The surface of strong woollen thread raised into loops, or cut open into a bristly elastic pile, was not only injured by the blocks, but it also failed adequately to receive from them the required pattern. Every attempt to print the Brussels carpet turned out a failure. Mr. Whytock applied his mind to the subject, and arrived at his conclusions regarding it by a curious, and yet what may seem, when the mode is described, sufficiently simple process. Take a piece of calico, bearing a complicated and handsome pattern; pull out the threads of which it is composed, and then mark the appearance of each individual thread. As seen analysed on every thread, if we may so speak, the pattern will seem but a number of succeeding bars of colour. The single thread, for half an inch or so, will be, mayhap, a green thread, for half an inch more, mayhap, a red thread —here black, there white, and so on in accordance with the peculiar line of the pattern which it chances to traverse. And thus the whole pattern may be resolved into a number of variously barred threads. But if it be thus easy to resolve a pattern stamped on cloth into a number of barred threads, it must be at least possible to resolve a number of barred threads into a pattern. It is much easier to convert a palace into a heap of stones than a heap of stones into a palace, but both processes are equally possible. Such were the reasonings of Mr. Whytock; and, on the principle which they embody, he set himself to build up beautiful and tasteful patterns of barred threads, in order to produce a Brussels pattern of but one layer of coloured worsteds. We need scarce remind the reader of the amount of nice calculation and ingenious contrivance which his task must have involved. Every carpet consists of repetitions of certain sets of patterns, and so there must be a recurrence of the same sort of threads. But no two threads barred in exactly the same fashion go together. There is a continual variation, on whose nice adjustment the integrity of the pattern depends, and hence the necessity of much care and correctness in the calculations. In the thread, too, the bars of colour have to be broader in a certain proportion, than it is intended they should seem in the cloth, as allowance has to be made for the amount of thread lost in the loop or pile which forms the surface; and so the pattern in the warp had to be made quite a different sort of thing from the proposed pattern in the web; hence another set of difficulties. But Mr. Whytock succeeded in overcoming them all, and in producing in the Brussels tissue, patterns of even greater beauty than in the manyplied carpets woven in the common style. We were much interested in his manufactory to see how simple the operation performed by each set of his mechanics in the different manufactures, and yet how regularly the complicated whole grew under their hands. One set of workmen were employed in carefully streaking across with colours, sets of threads spread on huge cylinders. Another set were engaged in fixing the dyes. A third set in setting up the threads after a given manner for the warp of the projected web. A fourth in weaving. All of them seemed to be workers in the dark, so far as the pattern was concerned; they merely measured off certain bars of colours after certain given proportions, or stretched in a particular given fashion a certain number of threads across a frame; or, when stretched and arranged, wove them into a web, and yet the patterns sprung up before them complete in every sprig, leaf, and petal, as if it had been as much a thing of spontaneous growth as the mosses and wild flowers of our woods and moors. The whole reminded us, in connection with the producing workmen, of those nice operations of instinct through which the wasp has been converted into so skilful a paper-maker, though unacquainted with the principles of his art, and the bee into so excellent a practical mathematician, without knowing anything of theoretic geometry."

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* In the existing state of the Brussels carpet trade, fabrics of two, three, or four frames, having respectively two-fifths, three-fifths, and four-fifths of the full complement of worsted yarn, occupy an important place. Hence has arisen a popular delusion that one Brussels carpet is as good as another, whether it be two or five frames, the disparity of quality not being considered in relation to price.

The economy of this improvement is to this day far from being thoroughly understood, even while it adds so largely to the carpet produce of the country; for not only is the jacquard superseded and the large frames done away with, but it is possible to place three looms to be occupied on this new fabric into the space which one Brussels loom requires. One beam is substituted for thirteen hundred little beams or bobbins, and a better cover is made with 780 threads than with 2,600. In so far as it may concern the printing, it precedes not only the weaving, but the warping, and all patterns are produced by means of the same blocks; to wit, the wooden pulley revolving in its box of colour. If it is intended to have many repetitions of the same object in the course of the web, a fuschia bud, for instance, the coiling of the yarn round the cylinder brings all those buds, it may be thousands, which are to follow each other, equi-distantly in the same line, into such position that the opening of each bud may receive simultaneously its glowing tint. They are, as it were, brought into the position of the congregated necks of the Roman citizens which Nero desiderated, that one stroke might ensanguine them all. Pliny, who narrates as a marvel, that he had seen the fleece upon the living animal dyed purple, and scarlet, and violet, just as though they had been produced by nature in this form to meet the demand of luxury, would here indeed have a greater wonder to record, and Raphael would have congratulated himself on such a method of representing in tapestry his cartoons. As a proximate indication, the British tapestry of Messrs. Henderson and Widnell, of Lasswade, and the Arras ecossais of Mr. Whytock, may be cited. Such, indeed, is the true position and capacity of this colouring process, but the downward course of all manufactures in this country has only caused the invention, in great part, as yet to assist in gorging the market with carpets for the million. Particularly, of late years, the use of a low quality of material, and a very small quantity even of that, produces a flimsy article, which has tended greatly to disgust even the all-consuming and most unfastidious million itself.

The Patent Axminster carpets of Mr. James Templeton, of Glasgow, demand our favourable notice. Although bearing the name of a place once celebrated for its Anglo-Persian carpets with tufted pile, they are made on the Chenille principle, the worsted yarn being thrown in as woof instead of being inserted by hand-knotting. Mr. Templeton has the merit of having produced some of the very finest specimens of carpeting and rugs which this country has seen, and may fairly be said to rival the Axminster, the article being also produced with less labour and expense. Until very lately this manufacture was confined to Glasgow, but has now been successfully introduced into France.

In regard to the introduction of power-looms, their application has been so far tested that we may consider their success to be a matter of certainty. We shall proceed to enumerate the various inventions bearing upon the subject. That of M. Sievier is an attempt to knock up a Brussels pile without the use of the wire, but only applicable to the weaving of one layer of white and plain worsted warp, presenting a surface afterwards to receive its pattern from the printing of blocks. Mr. Burch patented a process to facilitate this printing operation, the result of both these inventions produces the carpets of Mr. Bright, of Manchester, which, from the cheapness of the manufacture, have commanded a large export sale. In 1842, Mr. Wood took out the first patent for weaving the regular Brussels carpet by steam-power, and since then the power loom has grown gradually to a state of comparative perfection. Mr. Bigelow, of the United States, has acquired a very notable name for his improved carpet-weaving machinery, in the framing of which the saving of labour is the principal feature. A later improvement has been patented by Mr. Fawcett, of Kidderminster, which has for its object the saving of material; and in the years 1852-3, Mr. W. Wild, of Manchester, patented still further improvements, affecting the better regulation of the Brussels wire movement. The average result of all this organisation is that one power-loom can weave from four to five times the amount of one hand-loom, besides requiring a less number of hands, and producing a better and more regularly woven fabric. We may estimate the number of Brussels power-looms in England to be somewhere about 250, while the present aspect of the trade warrants the expectation, that within a very few years the number will be doubled. Mr. Crossley, of Halifax, informs me that there are in existence nearly 600 power-looms upon Mr. Whytock's patent process, capable of producing at the rate of 10,000 yards *per diem.*

The superiority—we might almost say the supremacy of the English—in the adaptation of mechanical agencies to textile fabrics, here admits of striking illustration. Second to none in this sphere of British enterprise is the firm of Messrs. John Crossley and Sons, of Halifax. Besides having done their utmost to develop the possibilities of Mr. Whytock's invention (in which they have been most successful), they have also been the most forward to avail themselves of all new appliances to the perfecting and economic production of the Brussels texture.

Thus much descriptive of the various productive processes; it remains to consider a more unwelcome feature in the present condition of the carpet manufacture. It is much to be lamented, but not to be concealed, that the principle of deterioration should be so alarmingly practised in our English manufactures. One reason of the success attendant upon the textile productions of France may be found in the reversion of the proverb—"*Meliora probant, deteriora sequuntur.*" In France they read—"*Meliora et meliora sequuntur;*" they go on improving, emulating better things; we are prone to deteriorate, and vie with each other in producing the cheapest lot of rubbish. Where French goods show a lower quality, we may easily discover that they are *got up* for the "nation of shopkeepers." The English manufacturer is much to be commiserated. He finds himself the victim of a circumstance of evil economy. His manufactory increases with a gigantic growth, to meet an increasing demand, which being supplied for a time, leaves the instrument of a rapid accumulation perhaps to whelm its owner. The monster of Frankenstein here finds a fitting parallel. The monster manufactory is inexorable, and would devour its maker when he ceases to feed its iron jaws. It must be fed, and its product accumulating, terrifies the manufacturer to flee to the false refuge of *reduced prices,*—prices which would go near to eat out their victim but for a corresponding reduction of quality and an unrighteous lowering of wages. These reductions cannot confine their influence to one manufactory alone, and the panic involves a general deterioration—a deterioration resulting in ruin. The effects of this have even already vibrated across the Atlantic, and unroofed a large establishment in Troy, U.S. Neither can we hope against hope that this may prove a solitary instance. This is an abuse which we cannot too prominently point at with the finger of warning, nor too unmercifully arraign and condemn.

Still another evil might be adverted to in terms of reprehension. No sooner does an ingenious manufacturer invent a new and excellent fabric, or protect, by letters patent, some useful improvement, than evasion is attempted by a low class of interloping traders. While the more manly-hearted and honourable acknowledge the merit of an invention, and lend their aid to its encouragement, they find their efforts counteracted by the depradations of rascally poachers. This is an occult science of thieving, against which the arm of prescribed law cannot be uplifted. The enactments of civilization pœnal to open crime, cast a set of tricksters upon their cunning, to plunder by more insidious methods.

We have thus far attempted to note the history of the carpet manufacture, dwelling at some length upon what appears to us its more interesting features. We have attempted to describe its later improvements, and to exhibit its present condition, to show wherein its true economy consists, as opposed to the false economy and practical folly of the deterioration process, which degrades manufacturing art to the level of the *low*, instead of trying to elevate the low to a higher appreciation. We shall now venture to inquire into the constituents of what is relatively good and bad in carpet design. It is not our province to speculate on those unequally discerned laws of the beautiful, whose neglect or transgression results in the unbeautiful; neither shall we enter at large upon those which are essential to beauty in form, with its contingents. This many-sided paradox has already found stammerers enough, essaying to umpire its apparent dissensions and oraculate its laws, but which have not yet received an appropriate investiture of language. It may be said, generally, that they are the conditions whereunto the external must conform, in order to excite within the soul pleasing and grateful emotions—an objective truth appealing to a subjective faith. And more particularly, that all authentic ornamentation must exhibit a certain degree of conformity to organic development, or observance of mathematical proportion. But this is a loose and vague circumscription. It may further be insisted, between what points is the ine of beauty to be drawn? At what point is conformity exceeded? What point verges on deformity? To the strict imitationist an exact conformity cannot be exceeded. To the caricaturist its very exactness is deformity. An explanation is here wanted. The matter may be said to assume two phases, resolvable into two schools, both opinionative enough, and whereon are hinged all those strivings about the law of ornamental design, which are unprofitable and vain. The one enjoins the exact imitation of nature, the other maintains with equal plausibility the virtue of nature travestied. This latter, while viewed historically, in so far as it may enter into the composition of the various traditionary forms of ornament, is also regarded as the basis for new operations. The imitative is dogmatic, and with much good has bred many evils; the travesty is high sounding but indeterminate, and while affording greater scope to the invention of the artist, yields a corresponding liability to error. Schiller has finely observed upon the detrimental effects resulting from the pretensions of the imagination to arrogate to itself the legislative where it only possesses the executive power. The imitative may yet be reclaimed from its prodigality; the travesty not yet launched upon the world in any new form has been guilty of no recent improprieties, unless, indeed, the very prodigality of the first may have arisen from a straining after a novel manifestation of the second. And for the rest, this vexed question is likely to live ever without settling, and truly, the solution of the problem were a consummation devoutly to be avoided. In our opinion, both are allowable, and neither can be circumscribed with laws sufficiently explicit to prevent their distortion. Their laws cannot, properly speaking, receive utterance, they are the intuitive sentiment of a discriminative good taste. Thus much concerning imitation and burlesque. We now come to another series of difficulties emanating from the mathematical or geometric school. As among certain Grecian philosophers, the science of geometry was exalted above, as embracing, all other philosophies, so do some ornamentationists of our own day strive to exalt it as the self-containing principle over every other style of ornamental art. This is a naked fallacy, scarce requiring exposure. Each ornamental style is *sui generis*, having a separate constitution and government, disdaining alliance with any other. The hermaphrodite needs not to have his shield quartered. Suppose we reduce the Gothic, Egyptian, and Moresque to one geometric original, does it follow, therefore, that these heterogeneous kinds of ornamentation should be mingled together, and used promiscuously in the composition of one design? By no means. They may be resolvable into straight lines or squares, into cycloids or circles, but nevertheless, each has its peculiar characteristics, its periodic development, its individual or national idiosyncracies, and must be employed with purity in the science of tectonic decoration—a purity not consisting of a simple copying of received originals, although partly dependant upon that as an initiation into its mysteries, an education to the production of new examples. We believe this heresy to be mainly at the bottom of the present Babel of designing, although we are far from denying the truth of the geometric principle in itself. It has been urged beyond its proper domain. But we are not yet quietly permitted to acknowledge the propriety of the recognised styles of ornamental art, by reason of a silly and trivial objection brought against them. We are told that they are traditionary. It might likewise be insinuated that language is traditionary, and man himself a tradition. This would not cause us to think the less of either, but, perhaps, rather the more. Certain styles of architecture being also traditionary, require a corresponding adaptation of ornamental forms. That there are fixed and immutable principles affecting their nature and composition, from which they may have, one and all, more or less diverged, may be an orthodox creed, but it is equally true that they are undefinable, and that man has a strong faith in the cogency of precedents. Thus we have seen that a spirit of enquiry, not having been tempered with a spirit of toleration, and viewing a many-sided question from one side alone, has degenerated into dogmatism. It is thus that the imitationist and caricaturist ignore the artistic title of each other. It is thus the geometrician determines within "the epicycle of his brain" that every coin should bear the image and superscription of his reigning idea. And it is thus the transcendentalist would in one word consign to oblivion what has been the growth of ages. Let us exercise a liberal judgment, and, by comparing the parts, establish the whole. Then let us modestly confess ourselves to be, after a sort, merely "ignorant admirers," having but a sorry insight into the very nature of the object of our admiration. A true feeling of beauty is in part unconscious, which, when interrogated, is constrained to reply, in the words of St. Augustine, "——if not asked, I know; but attempting to explain, I know not." Considering the object negatively, as implying a negation of beauty, we may infer, by antithesis, certain positive æsthetic principles; but, however well we may know the opposite extremes of conditional beauty and deformity, yet, as to their points of difference, the opinions of ornamentalists vary with the thickness of the line drawn between them. From all this, therefore, it should follow, as a corollary, that we regard with equal favour every fresh example of merit achieved by the disciples of the geometric school, as well as by those who tastefully imitate or gracefully travesty the organic forms of nature.

Now, be it remarked, in relation to the carpet, that every school of ornament affords capabilities for floor treatment; and here *flatness* is a law which seems to be conditionally borne out by the nature of the case. The arabesque, when so treated, is unexceptionable. We do not allude to that conventional form which might more properly be styled Raphaelesque; we use the term arabesque in its broader and original acceptation. The diaper or flat decorative, which all classes of ornament may be said to possess in some degree, we must esteem eminently suitable. Such are the delicate traceries of the Etruscan school, the involved curvings and intertwinings of the moresque, the well-defined mosaic of the Roman and Byzantine, the leafy growth of the Grecian, the spreading lotus and graceful papyrus of the Egyptian, the solid parquetrie of the Gothic and Elizabethan; and such is the bizarre Turkey carpet, the bejewelled Persian, and the inlaid flower-work of the Indian; nor is the vigorous grotesque of Chinese and Japanese ornament entirely below our using. The study of each individual style of ornamentation in respect of the elements of which it is compact, would materially aid in forming a correct idea of what is here most appropriate. Without entering upon these discursively, we may content ourselves with tracing the source of such a class of designs as may have become associated with the carpets of the East. Among the Mahomedans, the prohibition of the Sunni sect against the copying of animals and plants has now obtained almost entire observance in their carpet designs, whereas the laxity of the Shiah sect on this head, yielded in former times many specimens of that portraiture belonging to the imitative, which might be questionable enough on a floor. How else should we account for the fountain of lions and paintings in the Hall of Justice in the Alhambra? This building may be held as exhibiting in its decorations the comparative pretensions of the two sects at the period of its erection. An early aptitude for the flat ornamentation seems to have been developed with the faith of Islam. The carpets of Persia and Turkey expose to view an elaborate mosaic of jewels. We see in them no want of mathematical arrangement, but, on the contrary, a well-balanced proportion, whose beauty a happy arrangement of colour tends not a little to enhance. The copying of these designs, however, for English manufacture, is not always equally good, an especial failure in colour being frequently remarkable. The Indian carpet is not altogether so fantastic as the Mussulman. Some of them have a very irregular appearance, which is, nevertheless, a result of regular distribution. If any are not diagonal, yet, as Sir David Brewster has observed in the *Edinburgh Review*, "when viewed from different obliquities, as on a floor, they present a pleasing and natural perspective;" at the same time, a preference is shown to mathematical proportion. The Indian colouring is mostly warm and mild, save in a few instances, where it inclines towards the red chalk and yellow ochre.

A vulgar error of daily practice now claims consideration. We know not to whom we are indebted as the disturber of a false theory of shadows, lying at the root of much that is incongruous and unpleasing in the carpet pattern; but, assuredly, we are sensible of the force of the disturbance. The abstract question of light and shade is not here admissible; it is the inappropriate employment of shadow in design which merits our reprehension. Shadow is used to give prominent effect to an object, and to use it well requires adaptation to the nature of the light diffused throughout the room to be decorated. On a wall or a ceiling, it is lawful under certain restrictions, but on a floor, it is in the last degree criminal alike against good taste and common sense. If this illusion of shadows were complete as attempted on the carpet, we could not but associate with it a painful feeling—a feeling as though we were walking on an uneven surface. Not only so, but the practical difficulty of treating it correctly is almost insuperable, for, the shadow falling away from the light, the apartment must be so lighted as to preserve the illusive effect. Suppose a chandelier to hang from the ceiling, the shadows must fall towards the walls of the chamber, but daylight must also be distributed from the same point, by cupola or sky-light, else by a side-light the shadows were false. Under a cross-light almost no system of shading could be carried out in the design of the carpet. It were a problem similar to that fabled region of the earth, where, as wise men of old time gravely believed, for twice forty-five days in the year, at the period of the solstice, the shadows fall *in contrarium*—in opposite directions. When the light of the sun, and the light of the lamp are admitted or dispensed from different, from opposite or from many quarters, the adjustment of conflicting shadows might well present an inexplicable sphinx riddle. The principle is radically wrong, and generally accompanies designs where the architectural or decorative of a wall or ceiling is transferred to the floor. Here we are treading on Gothic windows, stumbling over carved oaken bosses, or against the timber of a groined roof; there a massive gilt scroll-work of Louis Quartorze, encircles a perspective of trees and the eternal hills, and in some we have only to cast our eyes on the ground, and we shall see, rolling there, the blue sky of our antipodes.

There are those who condemn the use of a good thing, because they have only known its abuse. Floral or chintz design has become obnoxious to this prejudgment. Essentially of the imitative school, it finds little favour in the eyes of the caricaturist; while yet many of its faults are traceable to its departure from exactness. That flowers may be produced which the botanist can classify with accuracy, is thus a glory or a shame as you view it. Perhaps it may yet be demonstrated to the satisfaction of all concerned that many of those authentic styles of ornament, by us believed to be travesties, were originally considered by their first artists most excellent imitations. Indeed, in those eastern countries, whence we derive a considerable share of the carpets here in use, it is singular to observe the preference evinced by the natives for our exact imitations over their own productions. Many an Indian Rajah, a worshipper of cows, who bestows upon his divinity the best gifts of his substance, deems it no ordinary propitiation to present his favourite animal with a patent velvet pile carpet, glorious in all hues of nature, whereon to repose. In this country, for the present, floral taste has been in great part cloyed with a meretricious class of design, and hence this loathing of what is pure. Those who are above the baneful influence of such vitiated examples, can yet afford to admire much that is beautiful and simple in the flower composition. An ancient author has told us that beauty is the flower of health, and although our Flora be labouring under a temporary malady, the disease is not incurable. A healthy complexion will, ere long, declare the good condition of its essence. We cast no horoscope to divine the continued favour which will be shown to every well-devised treatment of the natural flower and foliage.

The great antiquity of heraldry, fostered by the pride of blood, may serve as an excuse for the blazoning of scutcheons on woven fabrics. To the influence of this doubtful species of ornamental art, we confess ourselves not a little beholden. "Every man of the children of Israel shall pitch by his own standard, with the ensign of their father's house," is the mosaic record of armorial bearings, carrying us as far back as we care to go, and inferring the devices of all nations and families from that day to this. Some have even contended for it a divine origin, concluding from the visions of the prophets. English ideas of heraldry are intimately wound up with the prevailing Teutonic element of our character. Hence our appropriation of the Gothic style in its adjunctive decoration. Nevertheless, we must allow this heraldic emblemising to be a homogeneous and universal symbology, embracing the hieroglyphics of Egypt no less than every cognisance of our herald's books. From a practical point of view, it recommends itself to us by virtue of its *flatness*, but must of necessity have a limited use. It has, however, the advantage of being only suitable for the decoration of that house whose coat-of-arms is represented, and on this account, even although it were open to objection, is free from being common. These remarks apply in some measure also to the clan tartans of Scotland, which are now attaining a questionable notoriety in the Brussels carpet. Although properly the distinctive style of a Highland clan, and confined to articles of dress, they have traversed their ancient limits, and are now also the fancy of the Southron for his person, and, however strange it may appear, for his house decoration. We might dispute the propriety of this taste, and the feasibility of attempting to produce on the warp surface of the Brussels fabric a semblance of the warp and weft clan tartan. In the light of fashion, however, it must needs be endured, but let a *veto* be passed against the representation of philabegs and sporrans, dirks and bagpipes, on any respectable carpet. No excuse of heraldry can serve their apology. We shall conclude with the words of Sir Thomas Browne, that "whimsicallest knight," as Coleridge called him, and let him play the *Oedipus* in this controversy:—

"We will not question the tongues of adders and vipers, described like an anchor, nor the picture of the *fleur-de-lis*, though, how far they agree unto the natural draughts, let every spectator determine. We will dispense with bears with long tails, such as are described in the figures of heaven; we shall tolerate flying horses, black swans, hydra-centaurs, harpies, and satyrs; for these are monstrosities, rarities, or else poetical fancies, whose shadowed moralities requite their substantial falsities. Wherein, indeed, we must not deny a liberty; nor is the hand of the painter more restrainable than the pen of the poet. But when the real works of nature or veritable acts of story are to be described, digressions are abberrations, and art being but the imitator or secondary representer, it must not vary from the verity of the example, or describe things otherwise than they truly are or have been. For hereby introducing false ideas of things, it perverts and deforms the face and symmetry of truth."

Before taking leave of our subject, we must not neglect to speak of the beneficial effects resulting from the Great Exhibition of 1851, and the French Exposition of 1855. A comparison of the various carpet fabrics there exhibited has tended to form a better and more correct apprehension of the nature and wants of the manufacture. A more decided improvement in design must be patent to all familiar with the trade, and a better educated taste is brought to bear upon its condition. As a necessary consequent, the position of the artist is more fully recognised, and perhaps it may yet be acknowledged that the producing powers of artistic skill in the matter of design, require quite as large a handling as in the grouping of an historical piece.

DISCUSSION.

Mr. George Wallis (Government School of Art, Birmingham,) says, in a note to the Secretary, that "it may be of some interest to state the origin of the application and extent of the operations in the United States, of Mr. Bigelow's power loom for weaving Brussels carpets.

"When I visited Clinton, Massachusetts, in 1853, there were thirty looms at work in the Bigelow Carpet Company's Factory, and others in the course of erection. Those in full operation were producing from twenty to twenty-four yards each per day, and in special cases 32½ yards. Each loom was attended by one weaver, a female. The goods varied in width ¾ths, ⅞ths, and one yard. Mr. Fairbanks, Mr. Bigelow's partner, who kindly accompanied me from Boston, informed me that the carpet loom was simply the extension of the principle originally applied by Mr. Bigelow to the manufacture of coach-lace by power. There were 100 of these coach-lace looms in full work in the Clinton Manufacturing Company's Factory, (a distinct concern from the Carpet Company) when I went over it. The origin of the carpet loom was visible enough to the most casual observer."

Mr. J. G. Crace, in a letter to the Secretary, says:—

"I regret very much that I am prevented, by a particular engagement, from attending the reading of Mr. Whytock's paper on Carpets this evening, and my inability, therefore, to take part in the subsequent discussion to which you have kindly invited me.

"If I were present I should certainly venture to offer some remarks on the present state of carpet manufacture, more particularly as regards the suitability of designs, and the arrangement of colours.

"I fear, if a competent opinion were given upon the hundreds of designs of carpets annually produced in this country, that few, indeed, would be commended for their true taste. In this the manufacturer is not wholly to blame, for I am aware that there is a scarcity of clever and able designers; but, on the other hand, I think that little judgment and discrimination are shown in the choice of designs, and far too small a remuneration is generally given.

"In the cheaper kinds of carpets, I would avoid grand, scrawling designs, and adopt a simpler geometric style of ornament, allowing of good contrasts of colour, far more effective, and in better keeping for the rooms in which they are generally used.

"Alluding next to Brussels carpets, the designs very rarely indeed express the nature of the material to which they ought to be adapted; and, what is worse, very frequently outrage common sense, by imitating objects in relief with their own proper shadows and cast shadows. In one of our best carpet warehouses I have remarked a design called Elizabethan, which was indeed a most accurate copy of a plaster ceiling at Hatfield-house, all the filletings and mouldings, with their shadowed projections are faithfully copied, and the compartments filled with strongly contrasted grounds of colour. A Gothic carpet is usually represented by a copy of some stone tracery, with all its mouldings so well shaded that one feels in treading on it as if walking on an ornamental gridiron.

"Did it never occur to our manufacturers or designers to seek in representations of the period, where designs of carpets and stuffs are frequent for appropriate examples either in tapestry pictures, or paintings, or engravings. Never will they find the designs appropriate for wood or stone carving applied to woven fabrics.

"It is the very essence of a carpet design that perfect flatness be preserved. Do not think that I would avoid natural flowers and other ornamental objects,—on the contrary, I wish to show that, by a judicious arrangement, these can be made to tell with far greater breadth, clearness, and beauty.

"In the coarser kinds of French tapestry carpets, it may have been remarked that each shadow of a flower, or leaf, or scroll, is given quite flatly, as if *appliqué*, producing by its breadth and clearness far more beauty of effect than if shaded like a painting. I do not object to flowers thus treated in a carpet, but I still consider they would be more appropriately introduced when drawn conventionally, suggesting the ornaments in a design without any kind of shadow.

"How beautiful are the designs of many of the carpets we receive from the East, more especially from India, where the rules that I advocate are most perfectly carried out. It is true, as Mr. Whytock has observed, the present natives of India much prefer the gay colouring of our own English carpets, but it must be remembered that the designs they now weave are descended to them from times far remote, when their knowledge of the arts and sciences was far above what it now is. I am delighted to find that considerable advance is making both in the quality, facility of manufacture, and the introduction of additional colours in Brussels carpets, for these will always be the principal kind of carpets used in this country.

"I think it would be very desirable if some distinctive mark or warranty as to the particular quality of carpet was adopted by respectable manufacturers, showing which had a three-thread ground, also the number of threads of worsted between each string of hemp. But this will be better discussed by others understanding more fully than myself the minutiæ of the manufacture.

"I now come to the Axminster and tapestry carpets. About sixty years ago, it may be more, there existed at Axminster, in Devon, a manufactory of carpets, the parent of the one now carried on at Wilton. In various noblemen's seats throughout the country, I have many times found carpets of most beautiful design, rich and varied in colour and form, fully carrying out the true principles, of excellent quality, tremendous substance, still looking grand and handsome, though faded and dirty, the glory of our carpet manufacture once, and far better than any we produce now. These are the carpets of sixty years ago, made at the factory at Axminster. It is evident that for the designs of those carpets men of first-rate talent were engaged, fully equal in ability to those now possessed by France. Again would I impress on our manufacturers, pay liberally for your patterns, get fewer of them, and study them more.

"The factory at Axminster was removed to Wilton, where it now exists, possessing still, I believe, many of the old designs, but though the quality of the carpets produced there is still excellent, indeed the most solid of any produced in this country, yet I cannot say quite so much in favour of the new designs as of those sixty years ago.

"The tapestry carpets of Messrs. Whytock and Messrs. Crossley, and the Patent Axminster of Messrs. Templeton, are most ingenious inventions, and admit of great variety and richness of colouring, but the very facilities acquired of introducing any number of colours have led to a redundancy of the colours employed, and thereby a want of that repose so essential to a tasteful carpet, and this leads me to the subject of colour.

"I fear that manufacturers too often forget that a carpet, however beautiful in itself, is not the only object to be considered in a room. It ought to form only one part of a picturesque whole—not destroying the decorations and colouring of the walls and ceilings, nor the draperies and furniture; but harmonising with them, and from its very mass preserving so quiet an appearance as not to come too strongly before the rest. But granted even that the walls are too quiet or too bad to be injured by the gaudiness of the carpet, there are still the fair occupants of the room to be considered; their dresses, and even their beauty, may be sadly injured by the too glaring gaiety of what they tread upon.

"On the other hand, I most thoroughly abominate those shades of drab and stone, those tones of dirt, so recommended that dirt may not be seen upon them. However aggravating may be over-gaiety, I prefer it infinitely, with its freshness, to the dingy dirty shades, almost always, be it observed in the shape of inappropriate shaded scrolls, or gridiron ornaments.

"But these are the two extremes produced by ignorance in the science of the harmony and powers of colours. Our manufacturers, if not knowing much of the subject themselves, should, at any rate, have their sons trained to an intimate knowledge of this important branch of their trade, for, however well-drawn may be a design, it will probably be sacrificed if competent skill is not displayed in the varieties of its colouring."

Mr. Crossley, M.P., said they must all feel very much indebted to their friend Mr. Whytock, for the great care and research he had shown in order to give them the history of carpet manufacture for so long a time back; and he (Mr. Crossley) begged also to thank him for the flattering manner in which he had mentioned the firm of which he had the honour to be a member. He must, however, take exception to some remarks Mr. Whytock had thought proper to make upon tapestry carpets. He had stated that of late years the material had been so bad, and the quantity of that material used so little, that they had been so flimsey as to disgust the all-consuming and most unfastidious million itself. The specimen he held in his hand was the lowest quality of tapestry carpet made in England. He might be told that some manufacturers had made a worse quality, but he believed there was no manufacturer who put a less quantity of material in than was contained in that he referred to; and he submitted that it was not to be spoken of in the way it had been in the paper. He would state the reason why a lower quality had been introduced, and in doing so he might be allowed to remark that, although there were no statistics on the subject, yet, from observations of his own on the continent, and also in America, he believed he was within bounds when he said that there were more carpets used in the United Kingdom than on the whole continent of Europe; and it was his conviction that there were more used in the United States of America than in this country and in the rest of Europe put together—although they had not more population than we had in this country. They found the effect to be this. When they kept up a very high quality without making anything lower,—as soon as their carpets went out to America, they were copied by manufacturers there in an inferior material, and sold at a less price than English carpets could be sold for, and a great loss of trade consequently ensued. The Americans said—"You put far more material into these goods than can show itself, owing to the worsted being so closely compressed; and though we do not complain of your price for the article you make, we want something cheaper; we do not buy so many carpets of you as we should do if they were at a price to suit our customers. We would rather have three carpets than two at the same price." That was to say, if they had so much a year to spend in carpets, they would rather have three carpets to cost the same price as two, provided the appearance could be kept up, as they much preferred the clean appearance of a new carpet to retaining the use of a dirty old one even though the quality were good. They thought it was not very desirable to lose their American customers, and he might say that they had some experience to guide them in that respect in reference to the woollen cloth manufacture. In spite of the notions of the English manufacturer as to how it should be made, the Americans had different notions, and said, "if you will not make what we want we will get it somewhere else." Now what the Americans wanted for their climate and tastes in the article of woollen cloth, was a description made from what was well known in the trade as spun upon the condensing principle. That was a system of spinning rather between worsted and woollen, and made a silky, thin, strong cloth, that suited the Americans, but the manufacturers of this country held out that that was not the way to make woollen cloth, judging entirely from what was wanted in this country, and not taking into account the different circumstances they had to provide for, and thus the Americans had to go to the continent, and now almost the entire cloth manufacture was removed from this country to Belgium and Germany on that account. They (the Messrs. Crossley) were anxious to take a lesson by this mismanagement and make what their customers wanted; and he submitted that, in introducing that quality, they had not run it below what was desirable. He believed it would wear as long in proportion to its price as the best quality that was made. Mr. Whytock had spoken of it as though the whole thing was run down to the lowest quality; but the fact was, they were making a large quantity of the best quality for those who chose to pay the price for them. A remark also had been made, that it was coupled with "an unrighteous lowering of wages." If Mr. Whytock meant by that that since power looms had been introduced hand weaving had been reduced, he (Mr. Crossley) quite agreed with him; the same thing—the reduction in the value of certain descriptions of labour—occurred when railways were introduced. But if he meant to say that the reduction of wages had been such that the weaver made less money now by power than he used to do by hand, or that a less amount of wages in the gross was paid in carpet making than before the power-loom came into operation, he (Mr. Crossley) must say, that he (Mr. Whytock) was not thoroughly acquainted with the facts of the case. When the Exhibition opened in 1851 they had no power-looms at work for the carpet manufacture, and they paid 14½d. a yard for weaving velvet carpets by hand; when they introduced the power-loom they paid 2½d. a yard for weaving the same thing, it being done much better than when 14½d. was paid for it. Now the reduction in price was enormous, and yet, at this reduction, as their books testified, their weavers earned, on the average, twelve per cent. more by power than they did by hand for the same number of hours' work. A reduction was made in the goods in proportion to the saving effected in the weaving; and he would undertake to say that no one of the men now at work at power-loom weaving would accept hand-loom weaving at 14½d. if it were offered them, unless their power-looms were taken from them. During the year 1851 they paid for wages on an average £150 a day, or £900 a week, but during the year 1855 they paid on the average £250 a day, or £1,500 a week; that was an increase of money paid in wages. Facts were stubborn things, and were better than a thousand arguments. He submitted that by these improvements an increased consumption on the part of the public was brought about, and the thing was doing a great good; for, although they were paying now twenty per cent. higher price for wool than they did in 1851, carpets were supplied to the public at a reduction in price of fourteen per cent. With regard to design, he quite agreed with Mr. Whytock that many gentlemen who had sprung from that Society, and others, had been far too arbitrary. Mr. Crace was the same; he spoke of a flat surface being the perfection of a carpet, and that any deviation from that was going away from the best. If he (Mr. Crace) had said that that was one good style, he (Mr. Crossley) would agree with him; but to say that that was the only good style, was equal to declaring that the Gothic style of architecture was the only true style, and that every house not built according to the principles of that style was bad. There were various styles of carpets as well as houses and everything else. With regard to shadows, he thought too much had been said in depreciation of shadows. They all knew that it was the fashion, when royalty was to pass, to strew the ground with flowers. Carpets indicated that if we threw down flowers in a room, with the light coming from one direction, they would reflect shadows; there could be no harm, in certain cases, in introducing shadows to that extent; if the public, when they put down carpets with shadows, placed the shadows towards the window, that, surely, could not be said to be the fault of the designer, and was a point which should be guarded against. If those gentlemen who talked so much about style had something to do with the difficulties to be contended with in manufacturing and bringing out the goods, they would find that sometimes the introducing a shadow would make the carpet much more effective, and cause it to sell much better. There was one other remark he wished to make, and that was with regard to the introduction of bagpipes and philabegs, and so on, into carpets. He was not aware that they had been introduced into carpets, but he was aware that they had been introduced into a mosaic rug, and he believed with very great taste. What he wanted to see was, that everything should be perfect in its style and good in its way. With regard to those mosaic rugs, although he was one of the manufacturers of that article, he did not think that there was any other fabric that did so much credit to the manufacturer as that did, because it had had so many difficulties to contend with. The one exhibited on the wall was the kind of rug he referred to, with a stag in the middle, surrounded by the tartan and other appendages, and forming a regular Scotch piece. That rug would always sell well, because it was a grand composition, and had something very novel about it. He submitted that, although it would be very bad taste to put such a design into a carpet, where it would be repeated all over the room, in a rug, which was only the centre of attraction, it was very effective. Last year he took out a patent for making another rug, on the back of a different pattern, so that there was one on one side for every day, and one on the other for Sundays and special occasions.

Mr. Lapworth was an advocate for the use of the power loom. In his younger days they used to pay as much for hand weaving when two colours only rose to the surface as was now paid for five. The consequence of the introduction of the power loom was, that there was a much greater consumption of carpets, and, as a matter of course, a greater number of men employed, and the less wealthy portion of the community would enjoy the comfort of a moderately good carpet, which had heretofore been considered articles almost of luxury. In matters of taste, he quite agreed with Mr. Crossley, that a manufacturer, in order to produce a large return, must cater for the million. Those who required articles of a higher taste could have them by paying for them. It had been stated, that in the Axminster manufacture, the designs had of late years become very inferior, but it must be remembered, that the designs were furnished to the manufacturer by the party requiring them; and he would like to know the manufacturer who would refuse to make an article according to a particular design, however contrary to good taste that design might be. He was glad to find his trade had commanded the notice of the Society of Arts. It had been complimented and elevated very much by Mr. Crossley, who had addressed the meeting so eloquently, and particularly by his becoming one of our legislators, a position which all in the trade could not hope to aspire to, although it would stimulate others, and thereby advance this important branch of our manufactures.

Mr. J. K. Harvey said that he was glad to hear the liberal opinions expressed by Mr. Whytock respecting the application of design to carpet manufacture, and begged to thank him for them. That fearful monstrosities had been produced in this department, was a fact which he must at once admit. At the same time, the arbitrary rules laid down by some of our decorators and artists respecting flat ornament and geometrical treatment, could not be carried out, as a general principle, by our manufacturers. This had been fully tested, both by the actual manufacturers and by retail dealers who were in the habit of getting their own designs manufactured. However Mr. Crace and others might advocate the flat principle of ornament for carpets, the public would not be satisfied with it; the ladies of this country, from the Queen on the throne down to the most humble of her sex, had, and he trusted always would have, great influence in this department, and he felt certain there were many gentlemen present who would fully bear him out when he said that, nine times out of ten, the most accomplished of the fair sex would prefer an arrangement of flowers or foliage to all the geometric forms ever produced. He did not wish by any means to deprecate the geometrical or flat style of design—both it and the floral were good in their place, when judiciously applied. Both were necessary to satisfy the desire which exists in the human mind for novelty, and most assuredly the manufacturer who attempted to carry either style out, and that alone, would fail in his efforts, and lose his money into the bargain. Before he sat down he wished to say a few words in defence of the manufacturers; that they had been guilty of bringing out some very extraordinary productions he granted, but they were not to blame for all. He could point to many instances where the parties who advocated the severe school principles had got their own designs done on their premises; and in the course of preparation for the loom such drawings had passed through his (Mr. Harvey's) hands. He had watched their progress, and the result had been complete failure, as the shelves of those who embarked in such speculations fully testified. Again, the private customer sometimes insisted on a particular style of pattern; the artist was sent for, and, whatever his private opinion might be, his duty was to supply the wants of the customer; the design was manufactured, and went out to the public as a specimen of the bad taste and bad judgment of the artist and manufacturer, when, in fact, the fault lay at the door of the fastidious customer whose peculiar whim had to be gratified. In this manner he had been obliged to execute flowers floating on water, rampant lions and greyhounds stuck into the four corners of the room, and such like abortions. No artist would, of his own accord, produce such things, and no manufacturer would, as a speculation, purchase such productions, should the artist foolishly attempt them.

Mr. W. Wood, after being twice called upon by the chairman, as the first inventor of the application of power to the weaving of Brussels and velvet pile carpets, said, that he felt considerable difficulty in speaking on Mr. Whytock's paper, as, instead of its being "On Recent Improvements in Carpet Manufacture," it was principally on its ancient history and on design, and that part of it which did treat on recent improvements was chiefly filled with an account (and that no novelty) of an improvement in warp-printing by a relative of the author's, whilst the mechanical improvements of recent times, which had created the greatest revolution that ever did occur in the carpet manufacture, were but very slightly dwelt on. As he (Mr. Wood) was the originator of, and had been chiefly occupied in carrying out, these mechanical improvements, he did not think it necessary or advisable that he should dwell upon them at the discussion of a paper which, whatever its title might profess, was nevertheless mainly treating on other matters. However, as the subject had been publicly alluded to, he would, if the Society of Arts wished it, write out, at his earliest opportunity, such an account of the application of steam-power to carpet weaving as his experience in it should enable him to do.* He thought this would be a better course than mixing up, as it were incidentally, the most important change that ever occurred in the carpet trade, with an account, however interesting it might be, of the labours of ancient goddesses and ladies in the making of carpets, or with the disputes between the doctors of design respecting what is or is not the proper mode of ornamenting carpets.

The CHAIRMAN said, the hour had arrived at which it was usual to close their discussions, and, in rising to move a vote of thanks to Mr. Whytock, for the very interesting paper he had read that evening, he would not detain the meeting by any lengthened remarks. Mr. Wood had given them some notion as to the difficulties inventors had to contend with in bringing their inventions into operation as commercial undertakings. Mr. Richard Whytock had also experienced great difficulties in bringing into operation his beautiful and ingenious invention for the manufacture of tapestry carpets. He went to Kidderminster and made arrangements with two of the most important manufacturers, at that time, to work his invention. but neither of them carried out the arrangements they had entered into. Finding that he could not induce any of the carpet manufacturers to work his invention, he persevered and worked it himself successfully for several years, but nevertheless did not succeed in overcoming the prejudices of the Kidderminster manufacturers. Fortunately for himself he called upon Messrs. John Crossley and Sons, of Halifax, who were not slow to perceive the advantages of his invention, and entered into an arrangement to work it under license. The result proved that the value of an invention mainly depends upon the skill and enterprise of the parties who work it. Mr. Sievier had been for several years working at his invention without any beneficial result, until it was taken up by Messrs. Bright and Company, in combination with the process of printing piled fabrics invented and perfected by Mr. Burch. The enterprise of Messrs. Bright and Company, coupled with the invention of Mr. Burch, gave a commercial value to Mr. Sievier's new mode of weaving piled fabrics, which had failed to obtain until taken up by them. Mr. Bigelow had a hard struggle in the United States, but when he exhibited his samples of Brussels carpeting woven by steam-power in the Great Exhibition of 1851, and brought them under the notice of Messrs. Crossley, together with the fact that he was working in the United States twenty-five or twenty-seven looms, they at once perceived the commercial importance of what he had achieved. Mr. Bigelow's patents and Messrs. Crossley's patents were conflicting, but instead of going to war with each other they wisely preferred peace, and coalesced their interests. But for the manufacturing skill and enterprise of Messrs. Crossley, the great advantages of Mr. Whytock's invention might not yet have been fully developed; and since their adoption of Mr. Bigelow's loom for weaving Brussels carpets by steam power, in the beginning of 1852, not less than 250 looms had been put to work, superseding at least 1000 hand looms. It was worthy of remark, that Messrs. Crossley had so far improved the loom sent over by Mr. Bigelow from the United States in 1852, that some of the looms made upon that plan had actually been broken up, although costing from £80 to £100 each, in order to replace them with looms possessing the improvements subsequently made by Messrs. Crossley, so rapid had been the march of improvement during the last four years, in looms for manufacturing Brussels and velvet pile carpeting. The economy effected in the production had likewise been very great. Under the hand-loom system there was but little difference in the cost of 2, 3, 4, and 5-frame carpets, while the cost of 6 or 7-frame was greatly enhanced. The result of the introduction of the power-loom had been to establish a proper relative difference in the cost of 2, 3, 4, and 5 frames, and to effect a saving of full 25 per cent. in the cost of six-frame Brussels and velvet pile carpets. All Persian and Turkish designs required six frames to give them proper effect, and hence the importance of the economy effected by the introduction of the power-loom, which would doubtless very soon entirely supersede the hand-loom. In the late Exhibition at Paris there were some beautiful specimens of tapestry carpeting from Berlin, the warps of which Messrs. Crossley had printed by Whytock's patent process, and which had been woven by their patent loom now in operation in that city. There were also some very good specimens of velvet pile carpeting from Vienna, but none made with printed warp, from which it was to be inferred that the manufacture had not yet been introduced into Austria. As regarded the subject of design, however, nature required variety. We were not always satisfied to look upon the same scenery, however beautiful. We liked the variations of the seasons, and we not only required different styles of design, but varieties of each different style, to suit the taste of everybody. Carpets the designs of which might be approved by persons of refined and cultivated taste, and which would find sale among a certain class in this country, if sent to the United States, or the South American market, would probably realise a loss of 40 per cent. to the merchant or manufacturer who ventured to export them. The manufacturer must supply the demands of his customers whether their taste were good or bad. With respect to design as applied to carpets, we were upon a par with our neighbours in France, except that there more care was evidently bestowed by the designer in preparing a pattern for the loom. The talent of the designer was also more highly appreciated, and more pains were accordingly taken to produce a perfect thing. On the wall was a specimen of real Persian carpet, and next to it a French imitation; the latter, possessing all the spirit of the former, was much more perfect in execution. Notwithstanding that we required varieties of style, he would say, that the pleasing effect of a carpet on the floor depended very much upon the flat treatment of the objects, whether flowers or ornaments, and upon a geometrical arrangement of the design. Any one who would take the trouble to observe a carpet in which the stems and branches were all running in one direction, and then went into another room where a design of a similar style was differently arranged, would find that the effect was much more agreeable in the latter than in the former. With regard to cheapness, Mr. Whytock and himself, who, he might say, dealt only with those who could afford to pay for a good article, were too apt to overlook the wants of the million and the competition in the export trade. He thought the observations Mr. Whytock had made upon that subject had not received sufficient consideration; again, as regarded the large manufacturers, he (the Chairman) thought, so far as the carpet trade was concerned, they had always produced the best goods. The excellence of Messrs. Crossley's tapestry carpets was pre-eminent over all others of the same description. Their qualities of excellence and cheapness were fully appreciated at the late Exhibition in Paris, and acknowledged by the award of a " Medaille d'honneur," and in addition the senior partner in the firm was made a Chevalier de la Legion d'Honneur. Mr. Wood was awarded a first-class medal for his loom, and, doubtless, had he brought under the notice of the jury the fact of his being the first inventor of a loom for weaving carpets by steam power, he would have received a still higher distinction, the wish and intention of the Imperial Commission being to confer honour upon original inventors. He would conclude by moving the cordial thanks of the meeting to Mr. Whytock.

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* Mr. Wood has been asked to prepare such a letter for publication in the *Journal*.—SEC. SOCIETY OF ARTS.

Mr. Crossley, M.P., had great pleasure in seconding the vote of thanks to Mr. Whytock. He would make one remark with regard to France; however well they might succeed there in other things, they were certainly not very successful in the manufacture of carpets made in breadths. They put a good deal of material in them, but not in a workmanlike manner, so that they did not wear well. In proof of that, he might say they were continually sending carpets to France, and paying no less than 73 per cent. duty and expenses on them. He could not allow that opportunity to pass without speaking in the highest terms of Mr. Whytock's uncle, the inventor of the beautiful process of which he (Mr. Crossley) held a specimen in his hand. All credit was due to him, because he was not a manufacturer; he was a country dealer, in Edinburgh. With regard to the difficulty of introducing power at first, Mr. Whytock had a very kind and strong feeling towards the weavers, and believed that its introduction would be to their detriment. His opinion had certainly very great weight with them (Messrs. Crossley), and they found no difficulty in getting as many workmen as they wanted to weave by hand, and it was not until the Americans really began to apply power, and threatened to shut them out of the market, that they were in right earnest about starting power-looms. The consequence had been that, instead of there being now half-a dozen manufactories of tapestry carpets in America, they were reduced to a single one—and the owner of that had even offered to sell it to Mr. Crossley at cost price, when he was over there last autumn, stating he could make better interest of his money by buying property in New York to let, than by making tapestry carpets. In conclusion, he had very great pleasure in seconding the vote of thanks to their esteemed young friend, to whom they were all very much indebted for his interesting paper.

Mr. Whytock, in acknowledging the vote of thanks undeservedly accorded to him by that meeting, said, it might be permitted him to confess, that it was not his intention to have stirred up so much strife. He could see that some parties were offended because he had said too little, and others because he had said too much. His apologies were due for presenting the Society with a mass of mere undigested notes upon a subject which admitted of a much more ample treatment, but this, owing to his circumstance of leisure and opportunity, had not been accomplished. Discussion, however, had been excited, and many facts and opinions elicited, which it was well to hear. Perhaps, however, it might be allowed him to take exception to a remark passed by Mr. Wood—a remark rather disparaging to Mr. Richard Whytock's own individual experiment and practice upon his own patent process. He was sure that Mr. Crossley would agree with him when he said that Mr. Whytock had himself produced quite as good and praiseworthy specimens of his own patent carpets as any other manufacturer; neither had the working of the principle been improved since it left his hands.

The Secretary announced that the paper to be read on the evening of Wednesday next, the 27th instant, was "On Some of the Animal and Vegetable Products constituting the Foreign Commerce of Liverpool," by Mr. Thomas C. Archer. On this evening George Moffatt, Esq., M.P., will preside.

Since the meeting, the Secretary has received the following communication from Mr. Joseph Burch, of Crag, near Macclesfield:—

"I have to express my regret that I had not the opportunity of hearing Mr. Whytock's paper read, and the discussion thereon.

"Carpet printing, my province in this branch of manufacture, and certainly not a very inconsiderable feature in this subject, receives but faint mention from Mr. Whytock; and Mr. Sievier's mode of beating up the pile by the action of the loom, instead of forming it by the ordinary use of the wire, is rather slightingly noticed. This ingenious invention is certainly deserving of more favour than Mr. Whyteck has bestowed upon it, as, excepting in the lowest qualities, it makes a very perfect terry, and in velvet piles the product is most perfect, and of greater strength than cloth made by the ordinary power, or hand loom.

"In the absence of Mr. Sievier, it is, therefore, fair to state that I have printed, during the last seven years (in partnership connection with Messrs. Bright and Co.), nearly four millions of yards of carpets, woven by Mr. Sievier's loom, including terry surface and velvet pile cloth of different qualities. I will, therefore, take the liberty to suggest, with all deference to Mr. Whytock, but in justice to Mr. Sievier, that the word 'successful' be introduced into that paragraph of the paper wherein it states that Mr. Sievier 'made an attempt' to beat up a pile without the use of the wire.

"In respect to the printing of terry Brussels and velvet pile carpet, I may state that, however unsuccessful all former attempts proved in the application of the colour and design to this description of fabric, it is now the daily avocation of ordinary workmen. Mr. Whytock, in his paper, states, 'the plan of stamping, instead of weaving, could never be brought to succeed. The strong surface woollen thread, raised into loops, or cut open into a bristly elastic pile, was not only injured by the blocks, but it also failed adequately to receive the required pattern. Every attempt to print the Brussels carpet turned out a failure.' With this evidence, I believe I may fairly claim to be the first who succeeded in the art; and as I make no secret of the manner in which I print upon terry and velvet pile carpets, I will, with your permission, add to the paper which I have promised you on Shawl Printing, a description of the mode by which I have not only succeeded in printing these rough materials without injury to the pile, but have also successfully driven the colours to the foundation of the terry, without destroying the delicate tracery of the design upon the surface. There now remains no difficulty in the production of designs upon carpets by this process; and I venture boldly to state, that there is no other mode which can bear comparison, in its general application to all styles, with the carpet-printing machine; for, with equal facility, every variety of design may be produced, from the delicately-tinted floral heaps which we are in the habit of walking upon, down to the unobtrusive mediæval or simple geometric; in fact, the carpet-printing machine will yield all fashions, including the most plain to the excessively elaborate, with little or no additional cost in the production. The principle of printing is identical in Mr. Whytock's warp-printing and by my method, the chemical combinations of the colouring matter the same; both are printed on wool, with only this distinction in the process, viz., the woollen warp is printed before it is woven, and the woollen pile or terry afterwards.

"With respect to the quantity of 'cheap rubbishing' carpets, to which Mr. Whytock's paper refers as being produced at the present time, I would suggest that this description is the poorer man's carpet—carpets for the million—yielding comforts hitherto beyond the reach of the industrious and honest artisan, and adding social benefits and new pleasures to his humble cottage-home. Such qualities need not interfere with the ordinary sale of Axminster, Wilton, and the superior carpets, neither should envious feelings pervade the minds of the favourites of fortune, because the floors of the humbler classes are by their introduction slightly strewn with flowers. Those who desire more rich and expensive floor coverings, and who, too frequently, can only estimate them by their price, may still maintain the distinction, and indulge the most extravagant taste, for, be assured, there are to be found many carpet dealers who will very obligingly charge the most exorbitant prices, in order to suit the requirements of this rather exclusive class of customers."

SURPLUS FROM PATENT OFFICE FEES.

A meeting of the Committee appointed by the Council to consider and report upon the letter of Sir Joseph Paxton, was held at the Society's House on Monday last. There were present, Lord Stanley, M.P., who was called to the chair, as Sir Joseph Paxton, M.P., was not able to attend at the commencement of the meeting, Messrs. W. B. Adams, J. G. Appold, F.R.S., J. M. Blashfield, J. Burch, Dugald Campbell, Henry Cole, C.B., Dr. J. H. Gilbert, Joseph Glynn, F.R.S., Peter Graham, Owen Jones, J. C. M'Donald, J. D. Morries Stirling, and G. F. Wilson, F.R.S. The following gentlemen also attended by invitation:—Messrs. T. Aston, R. Fletcher, T. Webster, F.R.S., B. Woodcroft, and C. Wordsworth.

It was moved by Mr. Joseph Glynn, F.R.S.; seconded by Mr. G. F. Wilson, F.R.S., and

Resolved,—That this Committee, in conjunction with the Committee of the British Association, wait upon the Commissioners of Patents and explain to them the objects of this and the former meeting, and ask their countenance and support.

It was moved by Mr. J. D. Morries Stirling; seconded by Mr. J. C. M'Donald, and

Resolved,—That the following gentlemen be requested to act on a Sub-Committee, for considering the details requisite to be carried out for placing the Patent Office in a state of efficiency:—

Mr. Theo. Aston.
Mr. Dugald Campbell.
Mr. Henry Cole, C.B.
Mr. Peter Graham.
Mr. Charles May.
Sir Joseph Paxton, M.P.
Lord Stanley, M.P.
Mr. J. D. Morries Stirling.
Mr. G. F. Wilson, F.R.S.

The following gentlemen have been added to the Committee:—Messrs. Robert Fletcher, Capt. L. L. Boscawen Ibbetson, F.R.S., Henry Medlock, and Henry Roberts.

Home Correspondence.

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TONNAGE REGISTRATION.

SIR,—With reference to Mr. Mitchell's letter on the "Liability of British Shipowners," published in the *Shipping and Mercantile Gazette* of the 11th inst., and in the *Society of Arts Journal* of the 15th, I am happy to find Mr. Mitchell in co-operation with myself, amounting even to rivalry, as to who shall promulgate the greatest amount of truth with a view to the prevention of shipwreck.

In my paper on Tonnage Registration, read before the Society of Arts on the 16th ult., the deficiencies of our present tonnage registration, not the general merits of the Merchant Shipping Act itself, was the subject matter of my exposition; and I exemplified this deficiency by alluding to various *minutiæ* of Government supervision of railways with a view to public safety from accident as being in striking contrast with the deficiency of Government supervision of shipping, by showing that all the detail of railway appliance is officially scrutinised, whilst the deep loading of ships, on which safety at sea so much depends, is not subjected by law to any restriction or official check, and is absolutely overlooked. Mr. Mitchell, in the discussion on my paper, rather reflected on me for not having brought forward the obligations imposed on shipowners for the *prevention* of accidents at sea; consequently, in my letter of the 17th ult., published in the *Society of Arts Journal* of the 25th, I quoted various items of shipping-requirement referred to in Part 4 of the Merchant Shipping Act for the prevention of accidents at sea; observing, however, that the deep loading of ships is not recognised by the Act as having anything to do with nautical danger; but still Mr. Mitchell is not satisfied, and by his letter published in the *Shipping and Mercantile Gazette* of the 11th inst., and in the *Society of Arts Journal* of the 15th, Mr. Mitchell himself brings forward Part 9 of the Merchant Shipping Act, observing that it is "entirely devoted to the *liabilities* of shipowners; and, from its having a special heading to denote this fact, it cannot be easily overlooked." Now, since Mr. Mitchell thus insists on this Part 9 of the Merchant Shipping Bill not being overlooked, though, in my opinion, irrelevant to Part 2 on Tonnage Registration, I would, in the first place, observe, that Mr. Mitchell, in his description of Part 9, as above quoted, has omitted the significant word "*limitation*." Part 9 of the Merchant Shipping Act of 1854, is textually devoted to the "LIMITATION of liability," which is an important distinction in contrasting railway and shipping liabilities, because I am not aware of any Act of Parliament to regulate the "*limitation of liability*" in the case of railway accidents. For example, among other items of "*limitation of liability*" in case of wreck, we find as follows:—"The shipowner shall not be answerable in damages to an extent beyond the value of the ship and the freight due or to grow due;" but, as some check against worthless ships being employed, the Act prescribes that "the value of the ship and freight in no case to be taken at less than £15 per register ton." And again, "The damages payable in each case of death or injury shall be assessed at £30"—(£30 per soul, neither more nor less.) Perhaps Mr. Mitchell will excuse my enumerating all the further "*limitations* of liability" under which, by Part 9 of the Act, shipowners are groaning. To exemplify the hardship imposed by the value of the ship and freight being assessed at £15 per register ton, such being the ordinary value of a sound, well-found ship, the case of the wreck of the emigrant ship *John* has been referred to by Mr. Mitchell, who states that the *John*, a ship of 465 tons register, "in May last, bound to Canada, with about 300 lives on board, was lost off Falmouth; the greater number of the passengers unfortunately perished, and the penalties of the Act were put in force." The grievance complained of in this case is, that the penalty was assessed at £15 per register ton, whereas the *John* was not worth one-third of the money. The editor of the *Shipping and Mercantile Gazette* writes as follows:—

"Would any of our readers, acquainted with the value of shipping, have been disposed to purchase the *John*, before she left Plymouth, at one-third of £15 per ton? "Here is a ruinous liability of, say £7,000 thrown on property that would, in all probability, be highly estimated at £2,000."

Now, does not this case of the *John*, a ship in which 300 lives were embarked, though not worth £5 per register ton, indicate that commercial shipping management sets all the penalties of the present law absolutely at defiance as respects human life. Cargo liable to damage from getting wet, such as cottons, teas, and sugars, cannot with commercial prudence be risked, like British subjects, in ships worth only £5 per ton. As to the amount of penalty liable to be exacted in the case of the *John*, on account of her 263 souls on board, "most of whom unfortunately perished," I believe that cases of railway accident can be quoted in which a greater amount of penalty has been actually paid in consequence of the death of one single individual than was exacted for the whole number of passengers who perished by the wreck of the *John*.

Mr. Mitchell appears, by his letter, to regard it as a great hardship that shipowners should in any respect be responsible for accidents from wreck at sea, inasmuch as their officers and servants are obliged to obtain a government certificate as to their competency for their duty. This question is quite irrelevant to my paper. Further, Mr. Mitchell states his conviction that "99 in every 100 of our shipowners knew nothing whatever of the nature or tendency of the new tonnage law until it was in full operation." Is it, therefore, a fact that the few gentlemen who constituted the various deputations of shipowners on the occasion of the preparation and passing of the Merchant Shipping Bill of 1854, were a self-constituted body, acting without the recognition of 99 in every 100 of our shipowners; and is this the personification of shipowners, in respect of whom it has been said that the Merchant Shipping Law of 1854 "has given every satisfaction to the Interests who are the best judges of its merits, or for whose Benefits it has been established?"

I am, sir, your very obedient servant,
CHARLES ATHERTON.

Woolwich Dockyard, Feb. 18, 1856.

DECIMAL SYSTEM FOR BANKERS AND MERCHANTS.

SIR,—I beg to contradict a statement in circulation to the effect that I have abandoned my proposal for a decimal system for bankers and merchants, to be founded on the twelfth or the hundredth of a pound as unit of account, which plan has been fully explained in the *Journal*, and against which I have met with no valid objection.

Your obedient servant,
SAMUEL A. GOOD.

H.M. Dockyard, Pembroke Dock,
Feb. 19, 1856.

To Correspondents.

ERRATUM.—Page 209, col. 1, seven teen lines from bottom, for £120,000, read £1,200,000.

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
London Inst., 7, Mr. John Ella, "On Music, Vocal and Instrumental."
Architects, 8, Mr. George J. Wigley, "Archæological Studies in Jerusalem."
Geographical, 8½., Capt. A. Parish, "On the Formation of Cyclones, and of the Tracks they pursue." 2. Mr. W. S. Gardner, "Notes on the Condition of the Gipsey Population of Moldavia, together with the Message of the Hospodar, relative to their Manumission." 3. "Extract of a Despatch from Governor O'Connor, dated Bathurst, Gambia, May 22nd, 1855, containing a report of his visit to the Island of Balama, on the West Coast of Africa."
TUES. Royal Inst., 3, Prof. Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Mr. G. P. Bidder, "On Mental Calculation."
Med. and Chirurg., 8½.
Zoological, 9.
WED. London Inst., 3, Mr. R. Grant, "On Elementary Astronomy."
Roy. Soc. Literature, 4½.
Microscopical, 7, Anniversary.
Society of Arts, 8, Mr. T. C. Archer, "On some of the Animal and Vegetable Products constituting the Foreign Commerce of Liverpool."
THURS. Royal Inst., 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.
FRI. Royal Inst., 8½, Prof. W. Thompson, "On the Origin and Transformations of Motive Power."
SAT. Asiatic, 2.
London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, Professor Odling, "On Organic Chemistry."
Medical, 7, Annual Meeting.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette February 15th*, 1856.]

Dated 19th October, 1855.

2343. William Armand Gilbee, 39, Rue de l'Echiquier, Paris—Improvements in the application of silicate of potash to hardening and preserving stones and calcareous metals. (A communication.)

Dated 10th December, 1855.

2785. Peter Armand le Comte de Fontaine Moreau, 4, South-street, Finsbury—Improvements in obtaining motive power by means of heated compressed air. (A communication.)

Dated 31st December, 1855.

2952. Sir John Scott Lillie, Pall-mall—Improvements in guns, firearms, and implements of war connected therewith.

Dated 17th January, 1856.

132. William Westbrooke Squires, M.D., Liverpool—Improvements in preventing the bursting of pipes and tubes for conveying liquids.

Dated 23rd January, 1856.

178. William Johnson, 47, Lincoln's-inn-fields—Improvements in the treatment and application of fatty, resinous, and gummy substances, and in the manufacture of pastes, greases, and soaps. (A communication.)

Dated 25th January, 1856.

207. Alexis Jean Dessales, 13, Rue des Enfants Rouges, Paris—Improvements in oil lamps and in reflectors for the same for railway carriages and other purposes.

Dated 26th January, 1856.

209. Alexander Dalgety, 76, Florence-road, Deptford—Improved self-acting stand or stilt for casks or barrels.
211. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in compressed air locomotive engines. (A communication.)
213. Patrick Doran, 10, Cornwallis street, Liverpool—Improvements in pneumatic apparatus for raising sunken vessels or other bodies under water, and for keeping afloat vessels or other bodies liable to sink.
215. William Spurrier, Birmingham—Improved method of attaching handles to metallic tea pots and other vessels, which method of attachment may also be applied to the fixing of castors on furniture and other like purposes.
217. Wilhelm Dreschfeld, Manchester—Improvement in, or addition to, rollers employed in spinning.
219. Alexander James Walker, New York, and William Bennett, Brooklyn, New York—Improved method of forming hat-bodies, or other felted articles.

Dated 28th January, 1856.

220. Abram Longbottom, 41, Moorgate-street, and William Longmaid, Victoria-cottage, Stoke Newington—Improvements in apparatus for generating and heating steam.
221. Peter and George Brown, Liverpool—Improvements in the method of cleaning, dressing, and preparing a certain description of seed or grain, called "dari," and frequently called "millet," and thereby rendering the same suitable for food.
225. Jean Baptiste Jules Hyppolite d'Auvergne, Blois—Improvements in portable writing or drawing desks.
227. Pierre Emmanuel Guérinot, Rue au Maire, Paris—Stopping instantaneously two railway trains running against each other.
229. Samuel Jabez Goode, Aston, near Birmingham—Improved gas stove.
231. Jean Hector Destibeaux, Paris—Improved waterproof fabric.
233. Henry Samuel King, Cornhill—Improved apparatus for printing and embossing. (A communication.)

Dated 29th January, 1856.

235. William John Simons, Royston—Improved governor for steam and other engines requiring governors.
237. William Henry Lancaster and James Smith, Liverpool—Improved arrangements for the application of gas and atmospheric air to the generation of heat in furnace or other flues, and the consumption of smoke.
239. James Fleming and George Fyfe, Glasgow—The consumption of smoke in engine and other fires.
241. William Fowler and William McCollin, Kingston-upon-Hull—Improved thrashing machine.
243. Samuel Palmer Gladstone, Lea-cottage, Orchard-house, Poplar—Improvements in the construction of masts and yards.
245. Abraham Pope, Edgware-road—Improvements in the manufacture of iron, copper, tin, and lead.

Dated 30th January, 1856.

247. Robert Walter Winfield, Birmingham—Improvements in the manufacture of metallic bedsteads and other articles of metallic furniture.
248. John Henry Walsh, Portland-place, Clapham-road—Improvements in omnibuses.
249. John Toward, Glasshouse Bridge Iron Works, Newcastle-upon-Tyne—Improvements in iron shipbuilding and in forming plates therefore, which plates are also applicable to other purposes where great strength is required.
250. Charles Frederick Claus, Latchford, Chester—Improvements in the preparation of hides or skins, also applicable to the preparation of the entrails of animals.
251. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the manufacture of cannon. (A communication.)
252. William Gossage, Widnes—Improvements in the manufacture of certain kinds of soap.
253. Thomas Fewster Wilkinson, 25, Bloomsbury-street, Bedford-square—Improvements in reaping and mowing machines.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 29, 1856.

ELEVENTH ORDINARY MEETING.

Wednesday, February 27, 1856.

The Eleventh Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 27th instant, George Moffatt, Esq., M.P., Vice-President, in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Baker, Robert.
Boucher, John.
Brassey, Thomas.
Callaghan, William.
Chater, Henry.
Chater, Joseph.
Dupré, John.
Houghton, George.
Lindsay, William Schaw, M.P.
Liardet, Capt. Francis, R.N.
Lye, John.
Obbard, Robert.
Robertson, Robert William.
Saxby John.
Scratchley, Arthur.
Shaw, William Edward, F.R.G.S.
Shearer, Bettesworth Pitt.

The paper read was

ON SOME OF THE ANIMAL AND VEGETABLE PRODUCTS CONSTITUTING THE FOREIGN COMMERCE OF LIVERPOOL.

By Thomas C. Archer.

In attempting to select from the vast list of vegetable and animal products imported into Liverpool, a few upon which to engage your attention, my chief difficulty arises from the multiplicity of objects which present themselves, each vying with the others in importance, and rendering it no easy task to choose which shall be the subjects of my paper.

I am led to think that the most useful course I can adopt will be to leave the great staple imports, about which information is easily obtained, and content myself with bringing under your notice other articles which are not so generally known, and do not, like tea and sugar, form matters of general consumption. I will also, without offending I hope, point out as I proceed some inaccuracies which a fellow-worker in this field has brought forward, inadvertently I am sure, in some papers he has read before this Society.

For convenience I will arrange the subjects of my communication under the following heads:—

(*a*.) Vegetable—1st. Alimentary substances; 2nd. Dyeing and tanning materials; 3rd. Materials used in various manufactures; 4th. Materia medica.

(*b*.) Animal substances.

Of the alimentary substances which have lately been imported, and which either have become, or might be beneficially made, regular articles of consumption, we have first the seed of a grass, *Glyceria fluitans* (R. Br.) the *Festuca fluitans* of Linnæus. This plant is a native of Britain, and is found abundantly in shallow stagnant waters and slowly running streams; although a most abundant bearer, the seeds are never collected in this country, but in Russia, the collection of the seeds is an important branch of industry. The mode of obtaining this grain is curious; the peasant takes an old felt-hat, and, wading in the water, skims the hat amongst the patches of *glyceria:* when the grain is ripe, the seeds fall into the hat, and in this manner are saved. I do not know the process used by the Russians for husking this grain, but they accomplish it very completely, and generally granulate it, in which state it resembles *Semolina*, and is called *Manna* or *Manna Croup*. Most of the vessels from the Russian Baltic ports bring small quantities, generally as presents, belonging to the captains; it is quite equal to the Indian Soojee, or the Italian Semolina. It is occasionally imported in another form, called *gritz;* in this state it is simply the fruit, or caryopsis, denuded of its covering. In both forms it is an excellent diet article, especially for children.

Large quantities of another graminaceous seed have also been frequently imported of late under the names of darra, durra, Persian grain, and minnot seed; it is the fruit of the broom corn, *Andropogon Sorghum*, (called broom corn because its stems form the material of which carpet-brooms and whisks are made). The imports of this grain for the last five years have averaged about 300 quarters. It is stated that the only application of durra is that of serving as food for poultry, but there are strong suspicions that poultry are not the only two-legged animals which feed upon this grain.

Several leguminous seeds have lately become known in our port; the most valuable is the seed of *Cicer arietinum*, the chick-pea, or Ceci, which is ground and used the same as pea-meal, than which it is, in all probability, more valuable; we usually received it from Turkey, but its native country appears to be India, where it is called gram, chuna, and dholl or dhall. It resembles in appearance some of the finer varieties of our garden peas. Not more than 200 quarters have been imported in the last five years. The nutritive qualities of this pulse are said to be remarkable, the Arabs often sustaining themselves through several days' journey upon a small bag of roasted dhall, which they slowly masticate whilst travelling. It is very extensively used through a great portion of the peninsula of India, as food for the poorer classes, and also for cattle, for both of which purposes it is occasionally roasted.

I gave the name of gram, amongst others, to the chick pea, but it must not be supposed that this article is always meant when that name is used, for the natives of India apply the term gram to several species of leguminous seeds, chiefly belonging to the genera *Phaseolus* and *Dolichos*.

Egyptian and French lentils are also occasionally imported, the former in considerable quantities, the latter only rarely, and in small parcels, chiefly for private use in the manufacture of soups, for which they are deservedly esteemed by the French. Both are the produce of the same species, *Ervum lens*, but superior culture has caused those from France to be more than double the size of the others, which are also darker in colour. Egyptian lentils are used for a variety of purposes, particularly in the manufacture of the empirical article called "Revalenta Arabica;" they are also used in soups.

Of the *feculas* or starches of commerce, we receive only a small quantity, if I except sago and the various forms of Mandioca starch and meal. The greatly increased Indian trade of the port of Liverpool has caused large importations of sago; and the intimate relations which have always existed between the Liverpool and Brazilian commercial establishments, have caused considerable importations of tapioca, cassava powder, and Mandioca meal, or farina, as it is most frequently called.

These substances, according to the best authorities,* are all produced, by different processes, from either of the two species used, viz.:—The Bitter Cassava, *Manihot utilissima* (Pohl), and the Sweet Cassava, *Manihot Aipi* (Pohl); the latter is not poisonous in its recent state.

The sweet cassava has been imported in very small quantities, in the form of small circular slices of the root, but no application has been found for them in this country.

The root of the bitter cassava is that chiefly used; it is a large, thick, fleshy tuber, internally of a yellowish white colour; the plant is an evergreen shrub, about three feet in height, and occupies about two square yards of surface. It is a native of Brazil, and is very largely cultivated throughout the greater part of South America, where it constitutes the staple food of the various nations and tribes, both of the civilised and savage populations.

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* Pereira and Pohl. Plant: Brasil: Icones et Descrip. 1827-31. Also Dr. Shier. Report on the Starch-producing Plants of British Guiana.

Mandioca meal, or farina, is prepared by rasping the large fleshy tubers upon wooden rasps of considerable size and of great hardness; specimens of these implements may be seen in the admirable Museum of Economic Botany at Kew. The soft pulpy mass is then put into a curious long bag, called a *tipitis*, made of strips from the stem or petioles of a palm; they are so plaited that when the handles placed at the ends are pulled, the *tipitis* stretches out in length but contracts in girth; the pulp is thus compressed, and the poisonous juice is squeezed out. This juice is boiled to the consistency of treacle, and then constitutes a delicious sauce, called cassareep, which has lost every trace of its poisonous property, and is so powerfully antiseptic that it preserves animal food for a great length of time, even in the tropics. When this juice is pressed out, the comparatively dry pulp is then washed in cold water as long as the water is rendered milky; the whitened water is then put aside for a time, and the starch subsides. This starch is then spread upon the bottom of a large shallow pan over a slow wood fire, and whilst drying it is frequently stirred. The heat destroys any trace of the poison which might otherwise remain, and at the same time it converts a portion of the starch into soluble dextrine, which agglutinates the mass, and gives it that broken rocky appearance so familiar to us in the tapioca of commerce, which is thus made. The bulk of the pulp has not been taken up by the water and is very useful, a considerable portion of the starch still remaining in the unbroken cells; it is therefore slowly dried, with very slight heat, and constitutes the farina, or Mandioca meal, which is to the Brazilian what the meal of grain is to Europeans. The cassava bread on the table is made from this meal; but the cassava powder or flour is the starch washed out of the roots of sweet cassava, which, as the plant is not poisonous, does not require the application of heat to remove the noxious properties; this fecula consequently resembles other pure starches.

Mr. P. L. Simmonds, in his paper "On New Farinas and Starches,"* states that "the green bitter cassava, when properly cultivated, will yield 25 tons to the acre, and this will give one-fifth of its weight in starch. Five tons of starch at, say, 6d. the pound, would give £56 per acre. Such a return as this would enable the West India colonies to inundate Great Britain with food, and at a rate which would make flour be considered a luxury. The meal of the cassava is in extensive use all through Africa and the Antilles, and is almost the only kind of farina used in Brazil. It is the *moussache* of the French colonists, and sometimes comes into commerce under the name of Brazilian arrowroot."

There are some errors in this statement, which I hope Mr. Simmonds will forgive me for pointing out. The first is, the incredible quantity which he has given as the produce of an acre of well cultivated cassava, and more especially the large amount of fecula, which he states at 5 tons.

I presume it is sufficiently well known that we are indebted to Dr. John Shier for the most perfect information respecting the cultivation, preparation, and produce of the cassava plant. Dr. Shier thoroughly investigated these important particulars, not from books or hearsay, but by absolute practice on the soil of South America; and he says, "If an acre of well-tilled, thorough-drained land yields 10 *tons of fresh roots*, and I have every reason to believe that such a return might be obtained, I have ascertained that the produce would be 3½ *tons of meal*, 593 lbs. of cassareep, and 2 *cwt. of starch*; and estimating the meal at 1d. per lb., the cassareep at 1s. 5d. per lb., and the starch at 40s. per cwt., the gross amount would be £78 13s. 4d. per acre." Whereas, according to Mr. Simmonds, if we add the value of the cassareep and meal to the starch, the value would be about £130. Another mistake that gentleman has fallen into, is in confounding the Mandioca or cassava *meal* with the Brazilian arrowroot, which is the cassava powder or starch, made by simply washing the sliced and bruised root of the sweet cassava.

The Mandioca meal is very largely imported into Liverpool, whence it is forwarded to Manchester, and other places, to be used as a starch for stiffening cotton goods. We also receive very large quantities of sago flour from India, which is used for the same purpose; it is the starch or sago washed out from the pith of the stems of the sago palms, but it does not undergo the curious process of *pearling* or *granulating*, which is applied to the sago intended for food.

Further on in the same paper, Mr. Simmonds alludes to another article which has lately been frequently introduced into Liverpool, I mean salep, which consists of the *tubers* of one or more species of terrestrial orchidaceous plants; but Mr. Simmonds calls salep a fecula. Thus he says, "The manner in which *salep* has been cheapened by the introduction *of other equally useful feculas*, shows the importance of greater attention to this profitable branch of tropical culture." Now, though containing some starch, salep is not, correctly speaking, a starch or fecula; its chief value arises from its forming an excellent nutritious diet drink. It is, however, now rarely used for this purpose, and I should have been much puzzled at the importation not only continuing, but also increasing, had I not traced a lot of this root to the manufactory of a chocolate maker, from which I presume that it is occasionally employed in that preparation.

My grounds for such a supposition are, I must confess, very slight, but, whether I am right or wrong, I am persuaded salep might be very advantageously employed in the manufacture of cocoa and chocolate. The very best salep is that yielded by our commonest indigenous orchid (*Orchis mascula*), which is very abundant in most parts of England. I have received lately, from my friend Dr. Theodore Martius, of Erlangen, a very fine sample of salep, prepared in Germany. It is far superior to the Indian salep, which is, in all probability, derived from plants growing in the most northern parts of Asia, probably species of *Orchis* and *Eulophia*.

I may here mention another article used by the chocolate makers, and very eagerly sought by them, it is the so-called "sassafras nuts," or *puchury beans*, which are in reality the seed lobes or cotyledons of the seeds of *Nectandra puchury*. They are valued for the peculiar flavour which they impart.

An article used for making a common Brazilian diet drink is often imported in small quantities, chiefly, if not altogether, for private use. It is called *Maté*, and in most parts of South America is a highly esteemed beverage. It consists of the leaves and young shoots of the Paraguay holly (*Ilex Paraguayensis*), broken up very small. An infusion is made of this material, which is handed round the table, and each person draws up a portion through a small curiously-formed tube, called a *bombilio* (from its having a small perforated bulb at the end to act as a strainer), usually of silver. I have been informed by some that this beverage is slightly intoxicating, but others of whom I have inquired have asserted that such is not the case. I shall set this question at rest by trying it with the first fresh sample I can procure. Those who have been accustomed to *maté* speak very highly of its cheering and invigorating effects; and if it should be found agreeable to the European palate, there is no doubt that an abundant supply could be obtained at a cheap rate.

Some fruits which are imported into Liverpool are very interesting, thus we now have the beautiful and delicately flavoured *Litchi* (the fruit of *Nephelium Litchi*), commonly imported and sold in our market. We also occasionally see the variety of orange called the Navel orange, of Brazil, which, when in good condition, is remarkably delicious; the little oranges with highly perfumed rind, called *Tangerine* oranges, and in a preserved state the Mandarin oranges of China (*Citrus nobilis*), and the Cumquat (probably *Citrus margarita*), also Chinese. I have also once seen the curious little "lime-berry" of Manilla and the Coromadel coast, (it is the fruit of *Glycosmis arborea*) not larger than a small grape; it has all the rich flavour of the lime, and the brilliant colour of the cherry; it is, however, mixed with a yellow variety equally pretty. Frequently in summer we have the large fruit of *Opuntia vulgaris* and *Opuntia tuna*, called prickly pears, or Indian figs, added to the variety of our fruit shops; they are imported from the South of Europe, where they are naturalised and cultivated. Once or twice lately importations of the Loquat, or apple-like fruit of the *Eriobotrya Japonica* have been received and sold, but their novelty and pretty appearance were their only recommendations; they came from the Azores, where they are cultivated. Of the walnut tribe we have several interesting species amongst our imports, and generally purchasable in the shops; thus the Pecan nut (usually from New Orleans), the fruit of *Carya olivaformis* and the Hickory nut (*Carya Alba* and *Carya Sulcata* often mixed), from North America generally. From Canada we receive the Hog nut (*Juglans porcina*) and the black walnut (*Juglans nigra*), but very rarely.

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* Vide *Journal of the Society of Arts*, Vol. III., page 774.

From Brazil we receive two nuts, one the well-known fruit of *Bertholletia excelsa*—called in London Brazil nut; in Liverpool, equally well-known as the Para nut and Castanha nut; of this the quantity imported is very large, amounting often to more than 20,000 bushels in one year. The other is the Sapucaia nut, which is highly prized for its superior delicacy; it is the produce of a large tree (*Lecythis ollaria*) closely allied to the one last mentioned. The Sapucaia nut is not a common import.

The Demerara or butter nut, called also *Souari* and sometimes *Suwarrow nut*, is occasionally received in small parcels, and commands a good price, usually about one shilling per pound, notwithstanding the enormous thickness and weight of the shells. It is the fruit of *Caryocar butyrosum*, and possibly other species of the same genus; the kernels are, unquestionably, the most delicious of all the edible nuts. Within the last three years, the fruit of a South American palm (the *Jubæa spectabilis* of the Kew Gardens) has been added to our imports, and considerable quantities have been received; they are small and round, about the size of a walnut, with a smooth ash-coloured shell, and hard indigestible kernel, with a cocoa nut flavour. They are sold under the captivating name of "little coker-nuts."

I must now draw my account of the alimentary substances to a close, and proceed with those used in dyeing and tanning. Liverpool commerce embraces a very large receipt of all the common dyeing and tanning substances, but I shall content myself with mentioning only two or three of the more interesting ones. Perhaps the most remarkable is the myrobalan, called generally by commercial men "myrabbolam." Twelve or thirteen years since, it was scarcely known in Great Britain, but last year the imports of Liverpool amounted to the very large quantity of 680 tons.

It is impossible to obtain the correct statistics of this article, for, owing to its taking the place, to a considerable extent, of galls in dyeing, it has been very frequently returned as *galls*. The myrobalan is also a very useful tanning material. It is the fruit of *Terminalia chebula*, and, I think, is usually gathered unripe, because it has a wrinkled surface generally; but in large lots many specimens may be found which are very plump and free from wrinkles; they are also double the usual size; I conclude these are the ripe fruit.

For similar purposes we have received one or two small lots of the seeds of *Hernandia ovigera*, from India; they were imported under the name of Hernant seeds. The bark of a species of oak, under the name of Quercitron bark, finds its way to Liverpool from the United States in very large quantities; it is the produce of *Quercus tinctoria*. This bark is crushed, and consists of loose short fibres and dust; it is extensively used in dyeing and tanning processes.

Under the third head I will mention the seeds used for expressing oil, which have, within the last few years, increased to a very great extent; they are chiefly from the East Indies.

Sessamum, or gingellie seed, the produce of *Sessamum orientale*, was unknown in Liverpool fourteen years since, but it is now a staple import, amounting to several thousand quarters per annum; the oil is also finding its way both to the Liverpool and London markets. Another seed, called Niger seed (*Verbesina sativa*), was introduced about the same time, and has kept pace with the gingellie seed.

Safflower seed (*Carthamus tinctorius*) is now coming in considerable quantities, and yields a very fine oil, equal to that of olives for many purposes; and thousands of quarters of seed, the produce of two or three species of mustard, are also sent annually from India, under the name of surzee seed, for crushing in the oil mills. The nuts of the acrid Euphorbiaceous plant, *Jatropha curcas*, the physic nut of the West Indies, is also occasionally imported, and owing to their drastic properties have occasioned much mischief to children and others who have been led to taste them on the quays; but the oil of these seeds is very largely imported under the name of "seed oil," this indefinite name having been adopted for the purpose of concealing the origin of the oil. It is expressed at Lisbon, and until lately was chiefly employed for the public lamps of that city. In this country the cloth workers of Yorkshire find it very useful, and cheaper than olive oil. The seeds are common through the West Indies, but Lisbon is said to be supplied from the Cape de Verd islands. It is an admirable burning oil, and I have no doubt it could be supplied in very large quantities from the West Indies and British Guiana, if attention were properly directed towards it. At present the Liverpool trade in this article is all in the hands of one firm, who are reaping a handsome profit from the importation.

The ground nut (*Arachis hypogæa*) occasionally comes in considerable quantities from the West Coast of Africa, and is used for expressing oil. This oil congeals at a comparatively high temperature.

The newest addition to our oil seeds is the produce of a leguminous plant (*Psoralea corylifolia*) from the East Indies; it was imported for the first time, I believe, this month, under its native name, *Bawchee seed;* its qualities are not known at present, as it has not yet been tested.

The Chinese are said to prepare a valuable painters' oil from a large pea. I do not know the particular plant, but I have a specimen of the oil, and it appears fully to warrant the praise which has been awarded to it.

Of fibrous materials I cannot say much which is satisfactory. Science has pointed the way, but it is no easy matter to drive, or even tempt, mercantile men out of the beaten track; the consequence is, that notwithstanding all which has been said and done respecting the discovery of new fibres, little has been done towards their introduction. We have had a few lots of the China grass (*Bœhmeria nivea*), but they were very long on hand. A beautiful fibre was imported in 1854, purporting to be pine-apple fibre from Manilla. I believe it is still on sale. Sir William Hooker kindly examined it for me, and decided that it was not common pine-apple fibre, though possibly it may be, and probably is, the produce of some species of Bromeliaceous plant. Another curious and promising fibre, resembling green wool, came from Brazil, under the name of Tecum, the produce of a palm-leaf; like the last, it met with no purchaser. The trade in the curious palm fibre called piassava or piaçaba, is considerable, amounting to 80 or 100 tons per annum. These singularly rounded fibres are the produce of two species of palm,—one kind, which is very coarse, comes from Ceara, the other, and better kind is from Para; both are the result of the same peculiarity in the palm tribe, namely, the tendency of the fibres of the petioles, or leaf stalks, to split into long round threads as the leaf dies away. The use of this material in making street brooms is well known. Another application, perhaps, is not so generally known, I allude to the employment of the smaller fibres for the purpose of mixing with bristles in the manufacture of cheap brushes.

We have received two sea-weeds from the island of Ceylon; one, called Agar agar, yields a thick jelly, which has been found useful in dressing cheap silks; it is the *Fucus spinosus*. The other is the *Plocaria candida*, or true Ceylon moss, and it has been found useless.

Of the gums of commerce we receive a considerable number, but so important a subject cannot well be treated as part of a paper; I shall, therefore, only allude to three. The first is gum arabic, of which we receive a small quantity only; so small, indeed, that I began to question the accuracy of Mr. P. L. Simmonds' assertion, that the imports (general) were 3,000 tons per annum. I find that the imports of 1854, under the head of gum arabic, were 2,022 tons, but it must be remembered that all gums resembling gum arabic, such as gum Senegal, and many others, are classified under this head, owing to the difficulty of telling one from another; but a moment's glance at the names of the countries from whence they come, is quite sufficient to show that they are the produce of different species of plants.

Gum copal reaches us from Western Africa in very large quantities; it is generally thought to be yielded by some species of Hymenæa, but, I believe, nothing positive is known concerning its origin. Large importations of the Kawrie gum of New Zealand have also taken place; this appears to be a true resin, and is said to be found always buried in the ground usually where forests have been burned. It has been attributed to a species of Dammara.

In the imports of materia medica nothing is more conspicuous than the enormous increase of nux vomica. Ten years since a ton of this article would have been a large annual import—it now sometimes exceeds a hundred tons. Its use in medicine will not account for this large increase, and our sanitary officers will do well to make observations upon the symptoms which attend the dying ale-drinker, for notwithstanding the fine testimonials of the recipients of casks of pale and bitter ales, my firm conviction is, that the pure bitter of strychnine is a valuable auxiliary to the brewer. Great efforts were made a few years since to introduce the wood of *Picrena excelsa*, a large tree producing a wood as intensely bitter as quassia, and, indeed, this wood was supposed by the importers to be quassia, but they entered it as *billet wood*, in order to evade the duty. The trick was eventually discovered, and this, together with the high rate of duty, has prevented the brewers receiving their supply of bitter wood. They have, doubtless, found a substitute.

The animal products which I propose to notice are very few. The most curious was a large importation of hyraceum, the singular production of the *Hyrax capensis*, or Cape Hyrax. It is not known whether it is the thickened urine, or some other secretion of the animal; it is found in the cavities of the rocks it frequents, and the importation I have mentioned consisted of several tons, intended to be used as guano, although it was originally introduced as a substitute for the costly Castor. That which was imported for manure was much mixed with sandstone, which greatly added to its bulk and weight.

Brazilian isinglass is becoming a very important article of commerce. Our imports are annually increasing, but we do not know satisfactorily from what fishes the material is derived. The examination of some hundreds of cases has led me to believe that the Brazilian isinglass is yielded by several species. The dried albumen of eggs, which was first received in 1851, has been imported from Havre, but I do not know for what purpose, I only know it was forwarded to some print works at Manchester.

Hippopotamus teeth are imported from time to time as sea-morse teeth; they are eagerly purchased by the dentists for artificial teeth. And beautiful articles are made from the so-called horn of another *Pachyderm*, the rhinoceros; this horn consists of compressed hair, and is in fact the whole hair of the animal condensed upon one point. Out of these quasi-horns the Ceylonese manufacture many pretty ornamental articles, such as vases, cornucopeias, &c. Once, and once only, have I seen an importation of trepang or sea-slug. It was one parcel imported by a Manilla lady, for her own especial delectation; but her husband, an Englishman, found it out, and sent it to me, begging as a favour that I would keep it, as he had a perfect horror of this Malayan *bon-bouche*. I gladly accepted of it, and it has enabled me to present specimens to the Trade Museum, and many other institutions, and to show them on the present occasion.

Since writing the above, a new importation has added another rare tropical fruit to the list of our dessert fruits; it is the Longan (*Nephelium longanum*), which has for the first time arrived at Liverpool within the last week; it is also of the same genus as the Litchi.

I also should have mentioned the seeds called marking nuts (*Semecarpus anacardium*), belonging to the same natural order as the common Cashew-nut, which is not unfrequently imported under various names. The last consignment, still in the port, was called Marany nuts. It contains, besides the kernel, a large proportion of a black acrid secretion, which is said to be used as varnish. I cannot, however, ascertain its destination, and should feel obliged to any member for information upon this subject.

SOME REMARKS ON MR. ARCHER'S PAPER.

By P. L. Simmonds.

[The Secretary having, at Mr. Archer's request, forwarded a copy of the foregoing paper to Mr. Simmonds, has received the following observations from him.]

Looking at the vast extent of the trade of Liverpool, the greatly superior amount of its tonnage compared with other British ports, and the interesting character of the products with which it carries on the greatest amount of trade, individually, I must acknowledge myself somewhat disappointed at the limited list of new products or possible articles of commerce which Mr. Archer has been able to bring before the notice of our Society.

The commercial advance of Liverpool is one of the wonders of the age, for in the last ten years it has doubled the amount of the shipping owned at the port, which now approximates to 1,000 vessels, registering nearly 1,000,000 tons, being 250,000 tons in excess of the port of London, and one-fourth of the whole tonnage of the United Kingdom. The tonnage entering at that port in 1854, from foreign and colonial ports, numbered 4,500 vessels, measuring nearly 2,250,000 tons, exclusive of its vast coasting trade.

The extent of the entire tonnage of Liverpool, inward and outward, in 1854, reached the enormous total of 7,675,689 tons, while that of London, with double the amount of coasting trade, was only 8,495,463 tons.

With a smaller amount of foreign tonnage, the commercial novelties reaching London year by year are, however, very numerous.

Cottons, wools, sugars, and grains from new quarters; new furniture and dye woods, new fibres and oils, new drugs, new succades and dried fruits, minerals from new quarters; on all these, although some indeed form "matters of general consumption," detailed information is greatly desired.

The important quarters to which the commerce of Liverpool is directed, North and South America, Central America, Australia, Africa, and latterly India, and the Pacific, would have led to the supposition that many novel products must have been introduced, and I had anticipated a large amount of new information respecting special articles that might have come into Liverpool incidentally from those quarters during the last few years.

The absence of a greater number must, I presume, be owing to a want of enterprise on the part of the Liverpool brokers and merchants in seeking out new products, rather than to any lack of industry or research on the part of Mr. Archer. That gentleman has possessed extraordinary facilities for examination and investigation of late years—as the collector of the imports of Liverpool shown at the Great Exhibition in 1851—as collector of specimens for the present Crystal Palace at Sydenham, for the British Association for the Advancement of Science, and as a Lecturer on these subjects at the Scientific Institutions at Liverpool, as well as from his connection with the Customs.

We are, nevertheless, much indebted to him for the varied information which he has brought forward this evening. While setting myself right on those points which he has called into question, I trust I may be permitted to supplement my quota of information on the different articles he has touched upon, especially as his paper is rather short.

The dhurra, of which Mr. Archer speaks, the *Andropogon Sorghum*, of Roxburgh, is not unlike the great Indian millet, the Guinea corn of the East and West Indies (*Sorghum vulgare*).

In Egypt only, I believe, it is known as dhurra; and we import large quantities from the Levant, in some years 20,000 to 40,000 quarters, which are sold in Mark-lane, not for poultry, but for human food. In India the Hindoostanee name is jowaree, and the Tamil name cholum. The grain, which in India is about the size of white mustard seed, is, according to Col. Sykes, sweet, palatable, and nutritive, and held in high estimation as the general food of those of the lower orders of India who do not inhabit the mountainous or jungly tracts. Although less rich in protein compounds than maize, or Guinea corn, jowaree is fully equal to many varieties of English wheat. While mentioning wheat, I may incidentally allude to the fact, that considerable imports were shipped to England from Calcutta last year. I have not heard this jowaree before called broom corn. The name broom corn is usually applied to another description of sorghum (*S. saccharatum*).

The urburree, or chenna (*Cicer arietinum*), the chick pea of England, is, as Mr. Archer well remarks, a very valuable pulse, forming in India a part of every farmer's cultivation. The grain is about the size of a marrow-fat pea, and its form is like a ram's head, whence its specific name. Although given to horses, it is also made into puddings and stirabout by the people, and even used as a bread grain, being ground into flour and made into cakes. [Sykes on the Cereals of India.] From the plant exuding oxalic acid, it is used in curries, instead of vinegar. Dhall is not applied to the pulse known as gram, but is the native name for the *Cytisus Cajan*, or *Cajanus flavus* of Decandolle, the pigeon pea of the West Indies, the pulse of which is, in India, the universal substitute for the split pea of Europe.

Mr. Archer seems to doubt the accuracy of my estimates with regard to the produce of cassava. A residence of several years in Jamaica as a planter, and large experience in the culture of that root, and of the other tropical food plants, enables me to reiterate the statement, and to aver that my estimates are rather underrated than overcharged as to the maximum yield. Has Mr. Archer any knowledge of the extent of roots that are even raised in temperate climates per acre? whilst the luxuriant produce of the tropics is widely different. I stated that the cassava, when properly cultivated, will yield 25 tons of root to the acre, and I did this not only from personal knowledge, but also from the very report of Dr. Shier from which Mr. Archer quotes an isolated passage. Dr. Shier was not a *cultivator*, but an agricultural chemist and experimental analyst, in the Laboratory at Georgetown, and I have always been ready to give due weight to his valuable observations and chemical researches. Indeed, the best proof of this is afforded by the large quotations I have made from his report to the Governor of British Guiana, on the starch-producing plants, and the favourable mention of it, in my work.

Dr. Shier, in that report, however, sets out by stating, that he confines himself principally to those matters "capable of being settled in the laboratory. On other points," he adds, "particularly those relating to the returns per acre, I am at present but imperfectly informed, in consequence of the limited extent to which these plants have hitherto been cultivated in this colony (Demerara), and from the total absence of authentic data regarding the amount of yield." However, Dr. Shier adds his conviction, from subsequent inquiries and investigations, that "in thorough-drained land, where the roots could penetrate the soil, and where its permeability would permit of their indefinite expansion, a return of 25 tons of cassava the acre might uniformly be calculated upon!" But this is not a mere opinion; it is borne out by actual results. On an estate at Essequibo, an acre of cassava, grown in fine permeable soil, was lifted and weighed, and it yielded 25 tons.

I am not in the habit of depending upon "books or hearsay," but have had absolute practice on the soil of the West India islands, and am too much engaged as a journalist, in commercial and statistical investigations to make unsupportable assertions or calculations without due consideration, and a thorough knowledge of the subject I am discussing.

And now as to the yield. I only assumed one-fifth. The proportion of starch from the cassava roots averages more than 25 per cent. of their weight, as will be seen by the following analyses given by Dr. Shier:—

	Per Centage of Starch.
Sweet cassava	26·92
Bitter cassava	24·84
Another sample	20·26
	72·02
Average of the three	24·00

The price of the starch will, of course, vary; 9d. a lb. was obtained in Glasgow for some shipped from Demerara, but this must necessarily depend upon the state of the markets, the extent of the demand, and the quality of the prepared article, whether it has been simply washed or undergone repeated purification and bleaching. I did not place any value upon the inspissated juice or cassareep, because it has been found unsaleable here, samples not meeting a purchaser, at least in London, and as for the quaqua or refuse portion of the fibre left after straining off the starch, it is, for the most part, thrown away as useless, and would not possess much commercial value, unless as food for pigs or calves.

In confirmation of the accuracy of my observations, I may be permitted to quote the following passage from a paper by Dr. Bowerbank, in the September number of the *Transactions of the Jamaica Society of Arts*, page 128, on bitter cassava. He remarks:—

"In the July number of the *Transactions* I attempted to show, from the statements and estimates of Dr. Shier, that the cultivation of the bitter cassava, and the preparation of its various products, both for exportation as also for home consumption, would be highly remunerative. Since writing the above, I have met with the following encouraging confirmation of Dr. Shier's views. It occurs in Mr. Simmonds's work, entitled 'The Commercial Products of the Vegetable Kingdom,' under the section Root Crops, article Cassava," and then he quotes at length my observations.

If my estimates and opinions thus pass unchallenged and meet approval in the colonies themselves, where these plants are well known and cultivated, it is, I think, a sufficient answer to Mr. Archer's *incredibility* as to the produce of root crops and yield of starch. But I may cite, for his further satisfaction, the produce of root crops in Europe. In Belgium, under good cultivation and a plentiful supply of manure, the produce of beetroot is 24 tons to the acre. In Ireland, owing to the extreme moisture of the climate, the produce varies from 20 to 30 tons per statute acre. Mr. Reeve, of Leatherhead, Surrey, in a paper read before the Royal Agricultural Society of England, in April, 1852, stated that he obtained a yield of 38 tons 16 cwt. of Silesian sugar beet from a heavy clay soil. In some parts of Scotland, 20 tons of potatoes to the acre have been grown.

Mr. Archer corrects my looseness of style in misapplying the terms "meal" and "fecula," but writing hastily and extensively, and principally addressing myself to commercial readers, I may, from adopting the commercial misnomers in general use, be occasionally chemically and scientifically inaccurate, and had I expected to be taken to task for these errors, I should either not have given forth my hasty observations at all, or pondered well my phrases and sentences. My communications to the Society's *Journal*, as the Secretary will confirm, have been usually written on the spur of the moment, when busily occupied with other literary engagements, after some incidental conversation, or in order to supply promptly my mite of information on any topic incidentally started, and appearing to require elucidation.

As to the alleged intoxicating properties of *Paraguay tea*, the Yerba Maté, I think there must be some mistake, although the opinion has been given currency to by the late Professor Johnson, in his "Chemistry of Common Life," but then he admits that no analysis has been made, or much authentic information obtained, as to its influence. No local writer that I have consulted mentions such a property in the beverage, although, unlike the Chinese tea, it is said to deteriorate by keeping. The trade in this holly-leaf to the South American republics must be very large, although no reliable statistics can be obtained, as it is all sent by land carriage from Paraguay.

With respect to the hickory nut, I may mention, on the authority of an American newspaper, that an excellent oil for burning and for machinery has recently been made from it in Ohio. It remains in a fluid state at a low temperature, is used in very delicate machinery, and, when properly refined, might be useful for watchmakers. The pig nut (*Carya porcina*) is preferred in the manufacture on account of its thin shell and greater abundance of oil. It is stated that oil manufactured from the ordinary shell-bark, and large sweet hickory nuts, would come into general use for the table.

Myrabolans.—The imports of this drupe as a tanning and dyeing material into Liverpool are even larger than stated by Mr. Archer. Last year the imports there exceeded 800 tons. They have been more in demand lately, at higher rates, owing to the scarcity of Shumac. A medicinal oil is obtained in India from the kernel of both the *Bellerica* and *Chebula myrabolans*.

Although occasionally used for tanning purposes in India from time immemorial, it is only within the last eight or ten years that they have come extensively into use in this country. The imports fluctuate, and as many as 2,000 tons have been received in some years. In 1853, a sudden commercial demand sprung up for them at Madras, and large profits were made by the persons who collected them in the jungles. As much as 700 tons were exported during the season from that quarter alone, being four times the quantity shipped in the two previous years.

Oil Seeds.—Of the Gingeley there are two or three varieties grown in India,—the black-seeded (*Sesamum orientale*), and a red-seeded variety, erroneously called rape, are the principal.

The plant is extensively cultivated, and the oil obtained from it is perhaps consumed to a greater extent than any other by the natives of India. The seeds yield 40 to 44 per cent. of a very pale straw-coloured, sweet-smelling oil, an excellent substitute for olive oil. It is also used in the East for anointing the person, for making soap, and for burning in lamps. Of 12,580 tons of the seed shipped from Madras in 1853, 636 tons came to England; and of 72,607 gallons of the oil imported from that Presidency, 42,043 gallons were shipped to the United Kingdom.

Safflower seed, also imported into London under the name of Curdee seed, is very similar in appearance to the seeds of the sun-flower, only whiter. The seeds furnish a light yellow clear oil, used for lamps, culinary, and other purposes.

Mustard Seed.—The imports of this so-called seed are largely on the increase from India. In the twelve months ending 1st Nov. last, 1,390,542 Indian maunds were shipped from Calcutta to Great Britain, against 191,264 Indian maunds in the corresponding period of 1854. The Indian maund is equal to 100lbs. troy. In 1853, 804 tons of the seed were shipped from Madras. Five or six species of the plant are cultivated in India, but the two principal are *Sinapis alba* and *Sinapis nigra*. The former yields by expression 36 per cent. of a bright yellow pleasant-tasted edible oil, having a strong smell and slight taste of mustard. The seeds of the latter yield only about 28 per cent. of oil. This valuable oil is used in most parts of India in cooking, and is considered superior to all others for anointing the body, which it is supposed to invigorate.

Large quantities of *Poppy seed* are now coming forward from India, and the imports last year were considerable, probably as much as 6,000 tons. The drying oil obtained from the seed is stated to be more extensively used in the opium districts, both for lamps and as food, than any other. It is asserted, I know not with what truth, that the use of this oil has a stupifying and injurious effect.

With respect to the *Jatropha oil*, it is now grown to some extent in India; and in the Madras exports a nondescript article, termed "lamp oil seeds," is shipped, occasionally reaching the extent of 5,500 tons per annum. This cannot be the castor oil seeds, which are also known in India as "lamp oil seeds," because these are particularly specified, and are also shipped to the extent of 600 or 700 tons. Dr. Lindley states, that the varnish used by the Chinese for covering boxes, is made by boiling the Jatropha nut oil with oxide of iron.

Niger Seed.—This black seed is the kala teel of Peninsular India, which is sometimes parched and made into sweetmeats, but is usually grown for its oil, which is locally used in cooking. It is the Rametill (*Giuzotea olifera*) of other parts of India.

In Ceylon, an oil is obtained from *Hernandia sonora*.

The ground nut is now grown to a considerable extent in India, the seeds being much eaten by the poorer classes, and the oil used for adulterating gingeley oil. The seeds yield about 43 per cent. of a clear, straw-coloured, edible oil. Considerable quantities of the stripped seeds have lately reached London from the East Indies, and been sold as ground-nut kernels.

The new oil seed alluded to by Mr. Archer, the *Psoralia Corylifolia*, bears the Hindoo name of Bawchan, according to Piddington's "Plants of India," and not Bawchee. It is the Bengalee Hakooch.

A small parcel of a new oil seed from Bombay, called Meilch, was recently received in London, which I have not yet been able to identify.

Of the Chinese pea alluded to by Mr. Archer, I have placed samples on the table, and I make the following extract respecting it from my work on Commercial Products. The plant is called teuss, and the dry paste, after the oil is extracted, tanping. Captain H. Biggs, in a communication to the Agricultural and Horticultural Society of India, in 1845, stated that of the esculents a large white pea forms the staple of the trade of Shanghae, or nearly so, to the astonishing amount of two-and-a-half millions sterling. (?) This he gives on the authority of the Rev. Mr. Medhurst, of Shanghae, and Mr. Thom, the British Consul at Ningpo. These peas are ground in a mill, and then pressed. The oil is used both for eating and burning; more for the latter purpose, however; and the cake, like large Gloucester cheeses, or small grindstones, in circular shape, is distributed about China in every direction, both as food for pigs and buffaloes, and also for manure. Dr. R. Thompson and some other writers have confounded this pea oil with tea oil.

Cotton seed, to the extent of 400 to 500 tons; fenugreck, fennel, coriander, and some other oil seeds, are imported from India in limited quantities.

The import of Indian linseed into Liverpool last year, was 756,950 quarters, and of rape seed, 162,353 quarters, and into London, 254,928 quarters. The ruling prices, per quarter, of these Indian oil seeds in London last month was—

Calcutta rape	67s. to 69s.
Yellow Bombay	69s.
Calcutta teel seed	69s.
Bombay sesame	72s.
Madras gingeley	70s.
Niger	56s.
Poppy	67s.

The mustard seed brought from the East scarcely deserves the name, for it has little or none of the pungent property of the true cultivated Sinapis. The difference in price bespeaks the quality; Dutch brown mustard seed fetches at present 22s. to 23s. the bushel, while the Indian mustard or rape seed is only worth 71s. or 72s. the quarter. I was shown recently by Messrs. Colman, the largest manufacturers of mustard, a beautiful specimen of true Indian mustard seed, imported many years ago, and which would be worth a very high price, but it has gone out of cultivation, and quantity, not quality, has led the growers to raise any kind of weed which furnishes the greatest bulk of seed.

East Indian seed oils have become important articles of importation, and go largely into consumption as substitutes for rape and other oils. The comparative wholesale prices on the 1st January, were, gingeley £51, rape £55, and ground nut, £52 per ton, duty paid. The indiscriminate use of teel, sesame and gingeley for almost one and the same article, leads to much confusion. Rape, surzee, mustard, and gingeley, are also confounded, and mistaken the one for the other by misapplied commercial names.

The total imports of these oil seeds into London last year, was 163,308 quarters, against 64,062 in 1854, and the requirement for our oil crushers is still largely on the increase.

The shipments of linseed last year from the port of Calcutta alone to Great Britain amounted to 1,647,884 Indian maunds, being nearly double the shipments of the previous year, and this was exclusive of the exports from Bombay and Madras. I may also mention the largely increased export of cotton from Calcutta, which last year reached 236,633 maunds, while in 1854 the shipment was but 5,035 maunds. Munjeet, Indian madder root and other staples also show a similar increase.

The question of Agar-Agar and Ceylon moss, has already been discussed, between Mr. Archer and myself, in the pages of the *Pharmaceutical Journal*, vol. 13, p. 355. I was not aware that the former ever came from Ceylon, it being a local commercial product of Singapore and the Eastern Archipelago. Of gum arabic, and the two resins alluded to by Mr. Archer, I have spoken at length in my paper read before the Society in November last, on the "Gums and Resins of Commerce."

My estimated statistics of the average imports of gum arabic, will, I think, be found tolerably correct.

The average deliveries to the trade in London, for the last few years, have been over 1,000 tons, whilst the present stock in London exceeds 1,200 tons, and this is exclusive of the imports at Liverpool, Southampton, and other ports. Senegal is separately specified, but it doubtless does happen that other unrated gums come in mixed with arabic.

In confirmation of the remarks of Mr. Archer on the increasing imports of Nux vomica, I may allude to the evidence I gave on this point when under examination, last year, before the Select Committee on the Adulteration of Food, Drinks, &c., of which our chairman was a member.

The imports of nux vomica into this port alone, in 1855, were 2.376 packages, of about 2 cwt. each, of which 1486 were taken for home use and export, and the present stock is 2114 packages. Of coculus indicus the deliveries last year were 1466 bags, and the stock on hand is 4618 bags, of about 1 cwt. each.

The bitter woods of the West Indies, as far as I know of Jamaica, consist of the Surinam bitter wood (*Quassia amara*); the lofty Jamaica bitter wood, furnishing the quassia chips of commerce, is the *Simaruba officinalis* of Decandolle; the *Picræna excelsa* of Lindley, and the mountain damson, or stave wood, *Simaruba officinalis*. The bitter wood alluded to by Mr. Archer, was a true quassia, and probably consisted of some 23 tons, shipped from Montego-bay, Jamaica, in 1851, of which I make mention in my work. Some years ago, the duty was about £8 or £9 the cwt.; then it was reduced to 10s.; and, as it is now only 1s. the cwt., there is no necessity for any subterfuge in the import. Indeed, this article of the Pharmacopœia is not at all objectionable, for chips of the wood, steeped a short time in water, afford a very wholesome tonic bitter; and a turner in Jamaica forwarded to the recent Paris Exhibition cups made of the wood. In using these, all that is requisite to produce a wholesome bitter morning draught, is to fill them with water at night, and cover them till early morning. The virtue will last in them a very long time.

A small quantity of hyraceum reached the London market about five years ago, and was sought to be brought into notice by some of our chemists as an antispasmodic, but did not succeed. Dr. Pereira took the trouble to analyse and describe it. (See *Pharm. Journal*, Vol. 10, p. 119.) It obtained some repute on the Continent from a laudatory treatise by Dr. Fikentscher, of Erlingen, and as the price it then realised at Hamburgh was 5s. a lb., unless it has lost its popularity there, it ought to have sold at a better price than manure would fetch.

In the paper which I read before the Society in November, 1854, I suggested the desirability of preserving the albumen of eggs, as a glaze and for other purposes, and I am glad to see the hint has been acted upon.

The extensive fishery for, and commerce in, the tripang, or sea slug, in the Eastern seas, is a matter deserving of more attention than has been given to it by our merchants. Ten years ago I gave some full details on the trade in my *Colonial Magazine*, Vol. 10, p. 189.

I would direct notice to some useful products of the horse-chestnut, which I have here in the form of flour, starch, and vermicelli, which, if they can be brought into the market cheap, may become of considerable commercial value, when we consider the abundance of the raw material and the large demand in the manufacturing districts here, as well as on the Continent, for starch for stiffening purposes. In order to obviate the necessity of trenching on food plants for this purpose, the Belgian Government recently offered a premium of £400 for some new starch, which would throw the large quantity of grain and roots now used into the market for human sustenance.

With respect to the marking nut, I may observe that forty-one bags from Cochin were offered at public sale today, but were bought in, no purchaser offering.

Having trespassed rather largely on the time of the meeting, I will now conclude by stating that I have placed on the table, from my own collection, for examination and comparison, samples of our London imports, of some of the articles specified in these remarks, namely :—

African gingeley—a white or mixed variety of seed.
Bombay sesame—a brown seed.
Teel—a black variety.
Meileh seed from Bombay.

Niger seed—the Ramtil of India.
The black and white so-called Indian mustard seeds of commerce.
Sursee seed—a kind of mixed wild Indian rape.
Small Dutch black mustard seed for comparison.
Poppy seed.
Curdee, or safflower seed.
Indian linseeds.
Peas from Shanghae from which oil is extracted.
Castor oil beans.
Myrobalans.
Hickory nuts.
Marking nuts.
Sassafras nuts.
Ground nut, kernels and in the shell.
Various oils from the different Indian seeds named.
Soft and hard Indian wheats recently imported.
Dhurra from the Levant.
Mandioc meal.
Pearl sago.
American cheap prepared isinglass.
Hyraceum.
Quassia simaruba bark, and a few other specimens.

DISCUSSION.

Mr. Keeling (of the firm Keeling and Hunt) was anxious that the meeting should not be deluded by the glowing description of Mr. Archer at the probability of their tables being decked with the delicious tropical fruits, specimens of which were shown and dilated upon that evening. The firm with which he (Mr. Keeling) was connected, had for years been directing their attention to the import of articles of fruit, the great reduction of duty tending materially to lessen their cost; but they had found, upon repeated trials, that the productions of any country, with the exception of articles of the nut species, would not bear a voyage beyond twenty-eight days, either by steam or sailing vessel, without injury to the article. The only countries that could supply England, by reason of the limited distance, were France, Spain, Portugal, the Azores, Malta, Sicily, Belgium, and Holland. The importation of pine apples from the Bahamas was of recent date, and was the extreme limit that could be ventured upon to import so perishable an article, and even that was attended with much risk. The "litchis" and "loquat," as well as other specimens of fruit from the Brazils exhibited by Mr. Archer, were only known in this country by name, small parcels, more from the novelty than the idea of their being introduced as fruits for dessert, being occasionally received in this country; therefore, the meeting must not luxuriate in the idea of any addition being made to the fruit luxuries, the distance from the East Indies, China, Japan, and the Brazils rendering it impracticable. The "loquat," or Nespres Japonica, as it was called by the Portuguese, was grown in Lisbon and the Azores, and resembled the common egg plum of England, but it was half its size. Some specimens had been received, but the flavour was not much admired. During the memorable famine year, his firm received many articles of food used in other countries in order to introduce them into this, and amongst them were two exhibited by Mr. Archer, namely, "Manna Croup" from Russia, and Lentils from Egypt. A controversy then took place with the Custom authorities as to the character of the former, in reference to levying duty, the article being different to what they had seen. Upon analysis it was found to be nothing more than "ground wheat"—manna croup being merely the Russian name for it; and being granulated in appearance resembled Semolina, and might be used as such; but the cost and expense of transit would act almost as a prohibition to any extensive importation to this country. The "Lentils" were in a dried state; they resembled a bean pod, and had a sweet liquorice flavour. The quantity imported was large, and although they were used extensively as an article of food in the East, and were of a nutritive character, they were thoroughly repudiated in this country, and after being tried in every quarter of the United Kingdom had ultimately to be sold, at a great sacrifice, for the purpose of feeding cattle.

Mr. Mechi thought that the papers which had been read were likely to have a very beneficial influence upon British agriculture. The cake made from oleaginous seeds, after the oil had been expressed, had been found of great service. He had used the castor oil cake with considerable advantage for feeding cattle. Mustard cake was also used very largely for manure, and as much as £7 a ton was paid for it for that purpose. In France the poppy was very much cultivated, and it was said that a large portion of the so-called olive oil of France, was, in fact, poppy oil. He had partaken of it and found it a very good substitute, and it was particularly wholesome. The cake that remained, after expressing the oil from the seed, was given to horses, and he (Mr. Mechi) had been told by a postmaster in France, who used it very extensively, that it had the effect of curing a broken-winded horse. He did not know whether the cake had ever been analysed, to ascertain its peculiar properties. The rape cake was very well known. It was clear that a vast quantity of these oleaginous seeds might be imported at very great advantage. As to lentils, or darra, a great quantity was at one time used for feeding pigs, when corn was cheap, but the price had recently become so high, that they could not be used advantageously. He was at a loss to account for the increase in the price, but in proportion to the increase in the price of wheat, so was the increase in the price of lentils.

Mr. R. T. Fauntleroy wished to correct Mr. Archer in one or two of the statements he had incidentally made. First, with respect to the value of ivory imported into Liverpool, he mentioned the price of £1,050 per *ton*. Now, ivory was never sold by the ton, but by the hundredweight, and it varied from £10 to £50 per cwt., according to size and quality; and at the recent public sales in Liverpool, ivory was sold at a price exceeding the highest rates for many years, and one lot only certainly was sold to a French buyer at £51 per cwt. (equal to £1,020 per ton); and he would now, Mr. Fauntleroy heard, be glad to dispose of it at cost price. But the *average* price of this sale was only £37 per cwt., and the average price of the total importations for the past year would be about £26 or £28 per cwt., or little more than *half* the price quoted by Mr. Archer. Again, with respect to seahorse or hippopotamus teeth, the two very fine ones produced were of the *curved* or most valuable description, and the price named, £15 for the pair, was very high—£10 would be nearer the mark. The straight or *upper*-jaw teeth were far less valuable. They were certainly used to a great extent for making artificial teeth, but also for many other purposes. The palm which produced piassava was, he believed, the *Cocos nucifera*, which also yielded the coquilla nut, used for ornamental turning.

Mr. Archer said Mr. Simmonds had expressed disappointment at the limited range of the subjects he (Mr. Archer) had brought before them; but he scarcely knew the regulations of the Society, though he had proportioned the materials to the time allowed. He regretted that more had been expected than he had furnished to them, for he could easily have gone more fully into the subject, having plenty of materials to enable him to do so. The sciences of Economic Botany and Zoology were as yet in an embryo state, and it was necessary to investigate them, in order to determine what were facts and what were not. He found that the most erroneous opinions were often brought forward in so positive a manner, that it was difficult to disbelieve them; but on investigation the truth was discovered, The so-called pine-apple fibre, which had been imported from Manilla, accompanied with what was said to be the leaves of the plant, had been submitted to Sir William Hooker for examination, and he had decided that, although the leaves were those of a plant which was closely allied to the pine-apple, they were not the leaves of a pine-apple plant. He must also correct a statement made by Mr. Simmonds, to the effect that he (Mr. Archer) was collecting specimens for the British Association, which was not exactly the case. A sum of money had been put at his disposal to enable him to collect as correct an account as possible of the animal, vegetable, and mineral imports into Liverpool during the last five years, so that a scientific as well as statistical work of reference might be formed, which did not exist at the present time, showing the exact amount of articles imported, and the uses to which they were applied. With respect to the question about the produce of the cassava root, both Mr. Simmonds and himself had quoted Dr. Shier; but the statements were so entirely conflicting, that they could only be settled by individuals making reference to the work for themselves. He was perfectly aware of the large amount realised per acre by some of our own roots; but there was a great deal of difference between a plant which occupied two square yards and another which occupied only one square foot. If it was Dr. Shier's statement, that the quantity of starch was 20 per cent., he (Mr. Archer) must withhold his belief until he had looked into the subject more fully. If that really was the proportion of starch in the cassava root, it produced a greater abundance than any other known plant, and ought to be much better known and more extensively used.

Mr. MECHI inquired if Mr. Archer had seen the sugar pod now used for feeding cattle.

Mr. ARCHER replied that he had; it was the St. John's bread, or "Johannes Bread" of the Germans, and was grown largely in Spain. With respect to the alleged intoxicating properties of Paraguay tea, he quite concurred with Mr. Simmonds in doubting that it possessed such properties. With regard to the hickory nut being a source for oil, he very much doubted whether it would ever be valuable for that purpose, and the application of the pig nut he considered still more impracticable; it was not only as hard as the hickory, but the shell was very much thicker, and the yield of oil would be exceedingly small. Mr. Simmonds had laid particular stress upon mustard seed as being *so-called*, but it was really and truly a mustard seed. Mr. Simmonds objected to it because it had not the flavour of mustard, but our white mustard seed was not the seed ordinarily used; it was the small black mustard seed which yielded the pungent condiment. Mr. Mechi had mentioned the use of the poppy seed in France. It was used to a very large extent, but when it was first introduced, Government had issued a prohibit against its use, from the fear of poisoning the people. It was now commonly used, not only as an edible oil, but for cattle food, and no danger was to be feared from its use. The seeds were much used for sprinkling the peculiar bread used by members of the Hebrew persuasion. Mr. Simmonds had also spoken of "Munjeet or Indian madder root," but Munjeet was one thing and Indian madder another. The first was a long fibrous root, whereas the other was in all respects like the short broken roots of the European madder. He (Mr. Archer) did not think he had endeavoured to lead to the impression that tropical fruits would be introduced largely into this country; but those on the table were all purchasable in the fruiterers' shops at Liverpool. He had much pleasure in hearing what Mr. Keeling had said upon the subject, for it showed that the merchants of Liverpool were much in advance of the very great men in London in receiving importations of those foreign fruits. He did not think that he had, as was stated by Mr. Fauntleroy, misled the meeting as to the value of ivory. He spoke of the specimens he had alluded to as being remarkably fine ones, and the difference between the prices quoted by Mr. Fauntleroy and himself, were too slight to notice (£30 upon a sum of £1050). The sum stated had been received from a merchant who was present at the sale as a purchaser, and it was not mentioned by him as an ordinary case, but as an exceptional one of a remarkable character.

Mr. KEELING said, with regard to the pine-apple fibre alluded to, the leaves of the pine-apple plant, in a particular phase of its growth, could be manufactured into a texture resembling fine cambric.

The CHAIRMAN said the article of isinglass had been mentioned in the papers. Dr. Taylor, before a Committee of the House of Commons on the adulteration of food, had given some very curious information upon the subject of isinglass. They were always accustomed to look upon that imported from Russia and Brazil as the finest. But Dr. Taylor had stated that there was a much purer gelatine obtained here at home for every purpose than any that was imported. He also gave evidence respecting *nux vomica*. The importation of it was certainly very largely on the increase, and it would no doubt be very interesting to all to know what was the cause of that increase.

Mr. SIMMONDS produced a sample of isinglass imported by Mr. Keeling from America.

The CHAIRMAN inquired from what source it was derived?

Mr. KEELING believed it was manufactured from fishbones boiled down. They did not encourage its importation, and looked upon it only as an adulteration.

The CHAIRMAN said the isinglass spoken of by Dr. Taylor as being obtainable in this country was procured from the inner skin of animals. Before they brought the proceedings to a close, he thought it would be the pleasure of the meeting that he should express to Mr. Archer and Mr. Simmonds their thanks for the papers they had read.

The Secretary announced that the paper to be read on the evening of Wednesday next, the 5th of March, was "The Progress of English Agriculture during the Last Fifteen Years," by Mr. C. W. Hoskyns. On this occasion H.R.H. Prince Albert, President of the Society, will occupy the chair. The Secretary further stated that *members only* would be admitted on that evening.

EXAMINATION OF MEMBERS OF CLASSES AT ASSOCIATED INSTITUTIONS.

The Council have great pleasure in publishing the subjoined resolution, which was passed at a meeting of the Institution Committee of the Leeds Mechanics' Institution and Literary Society, on Tuesday last. The Council would remind the members that the Leeds Mechanics' Institution has a larger number of subscribers than any in the United Kingdom. The value and importance of this testimony to the Society's proposals for the improvement and development of the education of the working classes, will, therefore, be at once appreciated.

"Resolved—That this Committee cordially approves of the Scheme of Examination laid down by the Council of the Society of Arts, in their *Journal* of date February 22nd, 1856, and recommends that the Scheme, with its details, be communicated to the pupils of the Day and Evening Classes of this Institution, with the offer to pay a sum, not exceeding £10, towards the expenses of sending Four Pupils to London for Examination. The eligibility of such pupils to be determined by the Head Master of the School, along with the Committee of the Schools and Classes; and that the Examination of the Candidates do take place on Thursday, May 15th."

PAPER MAKING MATERIALS.

Mr. James Withington, who has recently returned from China, after many years' residence there, finding on his arrival the great want of paper-making materials, has recently imported into this country a ton of four different sorts of paper cuttings, of which the particulars are given below.

The Society is indebted to Mr. Bennet Woodcroft, of the Patent Office, for having induced Mr. Withington to send the specimens for distribution to those manufacturers who may care to experiment on them and report to the Society.

Bale No. 1 contains 66 catties of paper cuttings, at 2 dollars 50 cents per picul of 100 catties, or 12 shillings and 6 pence for 133⅓lbs.* or 1⅛ pence per lb.

Bale No. 2 contains 79 catties; No. 3, 76 catties; No. 4, 65 catties; No. 5, 68 catties; No. 6, 69 catties; No. 7, 64 catties; in the whole 4 piculs 21 catties, at 2 dollars per picul, or 10 shillings for 133⅓ lbs., or 3⅗ farthings per lb.

Bale No. 8 contains 94 catties; No. 9, 94 catties; No. 10, 88 catties; and No. 11, 84 catties; in the whole 3 piculs 60 catties, at one dollar 30 cents per picul, or 6 shillings and 6 pence for 133⅓ lbs. or $2\frac{17}{50}$ farthings per lb.

The remaining five bales, Nos. 12 to 16, contain 10 bundles at 60 cents., or 3 shillings per bundle. These bales weigh on an average 60 lbs. each, or 1⅕ pence per pound.

Freight, insurance, and charges are to be added to the above. Freight is estimated at £5 per ton, and charges and insurance at 10 shillings per ton.

The contents of bales Nos. 1 to 11, inclusive, are cuttings of paper; and it is uncertain what quantities could be obtained; but, owing to the number of books made in China and the large amount of paper used for parcels, a few hundred tons could be had at any time.

The material contained in bales Nos. 12 to 16 could be obtained in any quantity. This manufacture is used very largely for making plaster for walls, and applied externally, being used for mixing with lime, the same as hair is employed in England; it is also used for tying up coarse parcels.

ON THE MANUFACTURE OF THE PERMANENT WAY OF RAILWAYS AS AN INTEGRAL BRANCH OF OUR IRON INDUSTRY.

By W. Bridges Adams.

The iron industry of Great Britain is emphatically indigenous, by the juxta-position of coal, ironstone, lime, climate, strong men, and cheap transit; a combination not yet known to exist in the same perfection in any other part of the world; a combination that will not fail till our coal and iron shall be consumed; and which, possibly, while our coal lasts, may induce the profitable import of iron ores from other regions.

All processes tending to increase our manufactured products in iron, by adding labour and machinery to the men and iron pigs, must be a gain to ironmasters as well as to the general community; and the more these operations can be rendered complete in themselves, without the need of secondary arts, the more perfect will they become.

Railways and iron ships are the two great staple consumers of iron. Ships are made, finished, and sold to all parts of the world; and it has long appeared to the writer a desirable thing that the permanent way of railways should obtain a like condition of completeness. With this view the writer pursued the investigation of the subject.

Reasoning from the rolling machines to the road, the writer came to the conclusion that the rails were only a part of the machine, forming together a tool of transit, and that a perfect locomotive with an imperfect rail was like a perfect lathe-head with an imperfect bed to it. The first and most evident defect was the total absence of any efficient mode of connecting the rails together at the joints. A railroad is better than a common road, simply by its harder and more even surface. But with a loose joint at every fifteen feet, it is quite possible for the rail to be a worse road than the macadam, *quoad* the loads running over it. The first object, therefore, was how best to patch their joints, and form the rails into continuous bars.

Rails may be generally divided into two classes,—those applied directly to the sleepers, and those applied through the agency of chairs—in other words, those forming their own base and those requiring an additional base. What is called the bridge-rail is of the former class, and also what is called the American or contractor's rail. In manufacture, the base of the bridge rail may be conveniently made to any width desirable. The base of the foot rail is limited by the process of manufacture to about 4 inches. The early foot rails were from 2¾in. to 3in. in height, by 4in. in width, of continuous base. The earlier bridge rails were from 3in. to 3¾in. in height, by 6in. in width, of continuous base.

The single T-rails and double I-rails were from 4¾in. to 5in. in height, with an intervallic base of 9in. to 11in., formed by cast chairs or shoes, which, however, raise the rail to 7in. above the sleeper.

The bridge and foot rails were mostly used with longitudinal timber sleepers, the T-rails with transverse sleepers.

By reason of the disproportion existing between the engines and rails, the deflecting caused the bridge rails to crush into the timber, and the T-rails to hammer into the chairs, producing destructive wear and costly maintenance of way, to remedy which many kinds of patchwork contrivances were devised.

The writer's first piece of patchwork was the contrivance now known far and wide as the "Fish-joint," *i.e.*, to apply iron fishes in the side channels of the double I-rails on either side of the joint, supporting the whole by a pair of chairs about 6 inches apart, with a view to make the rails a continuous bar, while permitting expansion and contraction. This patch has since been made an inferior patch, by the subsequent process of bolting to and through the rails for the sake of a lessened outlay at the cost of a heavier maintenance.

This fishing process was so unsatisfactory, that at a subsequent period the writer was led to consider the practicability of a better method, for the amount of existing rails was so considerable that many years had to elapse before they would be worn out. The patch of the fish was a patch in connection with the existing system of chairs, that is to say, the defects inherent in the chair system were palliated by the fish. The question then arose,—Was the chair essential to the proper support of the rail, or could any better support be adopted? The chair was evidently defective in two ways. It elevated the rail two inches above the sleeper, and from want of sufficiently firm connection to the rail, caused the destruction of the lower table. The method of improvement soon suggested itself. Allowing the rails to bear direct on the sleeper, and placing on each side an angle-formed bracket, or knee, fitting the side channels of the rails, and bolted thereto, and bolted also to the sleeper, precisely as the deck beam of a ship is secured to the timber by knees, gave a very practical result. The rails are lowered two inches, an efficient foot is firmly secured to them, loose keys are dispensed with, the bearing surface on the sleeper is increased, the lower table is saved from damage, and while the quantity of the cast metal at each joint bracket does not exceed the weight of the ordinary joint chair more than 6lbs. each, the intermediate brackets are each 10lbs. less than the intermediate chairs. By this process the double I-rails, being saved from damage, are really reversible. This is really a new system of cross sleeper-way, consisting of six types or forms,—rail, joint bracket, intermediate bracket, bolt, spike, and sleeper. This bracket system will be known in France as "*Le Système Console.*"

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* Note.—The dollar is worth 5s. sterling at the present time; the picul is 133⅓ lbs. weight; and the catty is $\frac{1}{100}$th part of a picul.

Amongst other things in the construction of a permanent way, not the least important is to lessen the number of parts or types. A fished cross-sleeper road consists of a rail, a chair, a wood key, a spike, a sleeper, a fish, and a fish bolt, in all seven parts. A bridge rail longitudinal road consists of a rail, a longitudinal sleeper, a fastening bolt, a joint plate, a joint bolt, an under joint plate, a cross transom, and a tie bolt; in all eight parts.

It is obviously a most difficult thing so to combine these parts as to constitute them an integral whole to resist vertical and lateral and compound vertical and lateral compression, the chief objects for which railways are preferred to macadam roads.

The double T-rail has integrally more vertical strength than the bridge rail, by reason of greater depth; it has less lateral strength and diagonal strength by reason of its lessened width.

The wood keys and the wood sleepers, it should be remembered, in no way help the integral strength of the rail. They are merely a packing or cushion, to keep the rails in position on the ballast, and the ballast has obviously no cohesive power to resist the crushing power of a locomotive wheel. If the rail be not sufficiently strong in itself to distribute the weight over a sufficient surface of ballast, no attempt to harden the ballast artificially, by packing or ramming by human labour, can remedy the evil.

The only remedy is to increase the width and depth of the rail bars, till they be absolutely inflexible, either vertically or laterally, beneath the rolling loads.

In the usual mode of applying rails by supporting them on their lower edges, this involves a considerable difficulty, as the base must be widened in proportion to the height. In the bridge rail the extreme height is about 4in. to 6in. base, the ordinary double T is 7in. height to about 11in. base; and even these proportions are insufficient to prevent the rocking of the rails by the lateral blows of the engine wheels.

Thus, if a bridge rail were required to be 7in. in vertical depth, to prevent deflection, it would require nearly 12in. base to prevent side rocking, and the vertical strength must be greatly increased to prevent vertical crushing.

Improvement in this direction seemed hopeless, and, therefore, the writer determined to begin at the beginning, setting forth the essential principles and then working them out mechanically. The principles he deemed essential are as follows:—

Firstly. That the depth vertically be sufficient to prevent all deflection by the rolling load, which must form the datum for calculation.

Secondly. That the width be sufficient to prevent all lateral deflection.

Thirdly. That the bearing surface in the ballast be sufficient to prevent any displacement by the rolling load.

Fourthly. That the joints be so formed as to constitute each line of rails a firm and a continuous base, with provision for expansion and contraction.

Fifthly. That the head of the rail, constituting the tread of the wheel, be the minimum of height above the bearing surface on the ballast.

Sixthly. That the head of the rail be of solid form, and not overhanging, in order to prevent crushing by the rolling of the wheels.

Seventhly. That in case of a double-headed rail, formed for the purpose of reversal, the arrangement be such as not to damage the lower head.

Eightly. That such a form be chosen as will give the maximum of strength with the minimum of weight of metal.

Ninthly. That the structure be such as to permit of such an amount of elasticity as to prevent destructive rigidity.

Tenthly. That there be no brittle or rotting material in the structure.

Eleventhly. That the parts or types of form be as few as possible.

Twelfthly. That the structure be such that any ironmaster can produce it complete in any required quantity, as a rope-maker produces cordage, and without requiring any skilled labour to apply it.

Thirteenthly. That the packing and repair be easy and accessible.

Fourteenthly. That the drainage be simple.

Fifteenthly. That it maintained its position in the ballast without tendency to displacement.

Practically, the writer found that for ordinary work it was desirable to have bars not less than 7 inches in total depth. To apply such bars in the ordinary method of supporting them on sleepers below, would have required a very strong and heavy vertical rib, with a very large base. This was out of the question.

The obvious method was to place the bearing flanges as close as possible to the head of the rail. The flange of the wheel being 1¼in. in depth, a clearance of ⅝ths will give 1⅞in. The thickness of flange being ⅝in. will give a total of 2½in. from the head of the rail to the bearing surface on the ballast, leaving 4½in. of keel below the bearing surface, to induce lateral steadiness. The breadth of bearing on the ballast being 13 inches, the depth of keel on the ballast 4½, and the elevation of the head above the ballast only 2½, it is obvious that the minimum tendency to rock is attained, with the maximum of vertical and lateral stiffness in the rail itself, and a solid nearly square head.

The first idea was to roll the rail whole, but in such case the convenience of rolling large and heavy rails would consume more metal than is essential for strength. As the vertical rib is practically suspended by the horizontal flanges, and does not act as a prop, it is clear that the thickness of the vertical rib need only be just so much as will firmly connect the upper and lower tables or heads together. About ⅝ths of an inch in thickness will practically suffice for this, and therefore the rail may be comparatively light, while possessing the strongest possible form of head for the wheels to run on. This process leaves two side channels, exactly adapted for the reception of two continuous angle brackets, or wings, with a vertical web of about 3½ inches, and a horizontal web of about 6½ inches, fulfilling all the requisite conditions.

These brackets afford yet another advantage. With the solid rail, it is essential to connect the rails together by joint plates of one kind or other, analogous to fishing. But the brackets can be arranged so as to break joint with the rails and with each other, in a mode that two solids will support every joint, analogous to the fibres of hemp in joining a rope. The two brackets and the rail, forming as it were three stands, are bolted together by bolts through all three, at every 18 inches, and this, in addition to the strength as a girder, forms practically a tensile cable, which will carry the rolling loads in case of the supporting ballast being accidentally worked away.

These rails and brackets thus forming a continuous support, and being self-sustaining in the ballast, require no sleepers to sustain them. For the purpose of determining rather than maintaining the gauge of way, cross tie-bars are provided, formed of plain bar iron, with the edge vertical, and with a short crank at each end to take any bolt connecting the brackets to the rails. On a straight line a tie-bar to every 9 feet run will be ample. On curves any number required may be applied, as every bolt hole in the rails and brackets will afford the needful fastening without any especial preparation. In laying out curves the rails will easily bend laterally, but not so the angle brackets. This can be provided for by preparing the brackets at the iron works, moulding them while heated from the rolls either by passing them through three rollers, or pressing in a cast iron trough. For a particular occasion, it would be practicable to produce the required curvature on the ground by hammering on one edge to expand it, and indenting upwards and downwards the opposite bracket.

As the brackets are continuous, the shoulders of the rails may form nearly a square channel, without being weakened, as would be the case with the ordinary double I-rails. And thus these brackets will retain their position without any strain in the bolts as is the case with those used for fishes, where the strain is excessive owing to the obtuseness of the angle of the rail shoulder. And as the bolts are below the brackets, the ballast forms a matrix to keep them tight.

As the bearing of the brackets is on the surface of the ballast, the quantity of ballast required will be only one-half that required for the ordinary cross sleeper road, where the bearing is ten to twelve inches below the surface; and another advantage follows. The raising or packing the rails is all surface work, whereas, on the ordinary road, the upper surface of the ballast must be removed in order to get at the lower. And it is, moreover, a much simpler process to apply ballast of equal consistence to a continuous longitudinal bearing than to the discontinuous bearings of cross sleepers. A deflecting rail especially requires equal packing, and it is rarely that two men can pack alike.

This suspended girder system is a multiple of only four parts or types—rail, bracket, bolt, and tie bar—in contradistinction to the seven and eight parts or types of the ordinary systems; and, taking a length of 18 feet single line, it will be found that the ordinary double I system has sixty-eight pieces, and the bridge rail system seventy-two pieces, to set against forty-six pieces on the girder system.

There remains the question of drainage. The object of providing drainage is, that surface water from the rain is apt to percolate and get below the sleepers or bearing surface. If coarse broken stone be the medium of support to the sleepers, such water can get away, but if a loamy gravel be used it will concrete together, become impervious to water, and form a series of transverse ponds some ten inches below the surface in which the sleepers will pump up and down by the pressure of the trains gradually loosening the whole system.

With the suspended girder system the bearing is on he surface, and the central keel below is covered in from action of rain. Supposing a foot of ballast on clay, the action of the rail bearers is to press out the water laterally between the non-porous surfaces above and below, just as a sponge may be squeezed dry between two plates.

As a practical people we are dissatisfied with any mere theoretic proof. A theory may be true in itself, but it may be grounded on false or insufficient data, which practice only can discover.

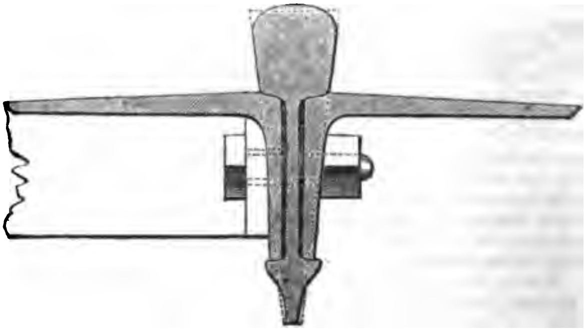
The two systems have been some time in use, and are in increasing use. On the Great Northern and the South-Western, the bracket system may be seen as applied to the double I-rails and cross sleepers, with satisfactory results. At King's-cross, on the Great Northern, the suspended girder system may be seen, after three months' daily use, under what is called the heaviest work in England, the up-coal-line laid on an upward incline of 1 in 110 on a slight curve, by the side of a wet clay hill. It is the first that was made; is very imperfectly prepared; and the frequent coal trains that run over it average about 300 tons gross. The rails give no sensations of hardness, nor any indications of unequal resistance. They have been submitted to the experimental proof of digging away the ballast, and leaving the rail as a bridge for a length of six feet, and then passing the heavy bank engine over the gap at the intersection of the joints.

This first sample was laid by men who had never before seen the rails, and the first trains ran over it without packing the ballast previously, but merely putting it in with the shovel.

This system, then, does fulfil the conditions required in a permanent way, and puts into the hands of our iron-masters the means of supplying it complete from their own works without any chance of error in laying down. It can be made in assorted sizes, to suit any kind of traffic, and can be laid down by any unskilled labourers, whether black men in Africa or red men in America. Engineers or merchants can thus order their permanent way as they would merchant bars, by the ton or by the mile. The system, with varieties, is equally suited for the heaviest locomotive work, for the light traffic of farms, for portable military rails, or for mineral lines.

The comparative cost, taking saving of ballast and laying down into account, will be found not to exceed the ordinary cross timber line, and in many cases it will be less. The maintenance in labour will not be one-half, and the saving in the renewals, with the difference of value in the old materials to be sold, together with interest in savings, will be equivalent to the reproduction of the line in the course of 21 years.

The following wood-cut, for which we are indebted to the kindness of the editor of the *Engineer*, shows a transverse section of the rail and brackets, with a portion of a tie bar, the rail being about 65lbs. per yard, and possessing double the vertical strength of an ordinary rail of the same weight. It is made with a single head, to save weight of iron on a line where the traffic is not frequent, and the rail will not wear out so rapidly as to require reversal.



Home Correspondence.

PATENT GRANTS.

Sir,—In the granting of a patent, the interference of lawyers of the Crown is, indeed, "worse than useless." It was thought so, I know, at the time the Patent Amendment Act was passed. Mr. Woodcroft's Indexes afford full information as to patents already granted; and a museum at the Great Seal Patent Office would show the various attempts made to produce a given effect. Patentees ought to pay all the expenses of that office; but beyond this it seems unreasonable to tax a man for his ingenuity.

I am, Sir, yours, &c.,
M. S. BENTHAM.

PATENT REFORM.

SIR,—I have not the advantage of being a member of the Committee on the Patent Office Surplus Fund question, and as I do not cease to be as much interested in all that regards patent reform as I formerly was, may I be allowed space in the Society's *Journal* for a few suggestions on this subject.

First, then, I would suggest (although I am opposed to grants to scientific men out of the *special* funds of the Patent Office, as I formerly stated in the *Journal*, conceiving as I do that they ought to be remunerated out of the *general* public funds), yet I consider that grants for scientific and practical inquiries and experiments, and payments to men of science for such purposes, would be perfectly legitimate; and further I may state that, to my knowledge, most inventors would support any arrangement for those objects.

Secondly. That a list of scientific and practical men should be made up at the Patent Office, and one or more should be chosen by the law officers, or the courts of law, as the case may be, to inquire, report, and give evidence in patent investigations and litigations, the expenses and remuneration of these official scientific witnesses to come out of the Patent Fund, and no extra charge to be incurred by the litigants, unless, indeed, the court thinks it right to specially mulct any one in the amount of such charges.

Thirdly. That the Government dues on patents be reduced, or rather I would prefer that patents for *seven years* be granted at *half the present charges*, as well as the 14 years' patents, as at present, these short patents to be subject to the same chance of renewal by the Privy Council as those for the longer term. I have many minor suggestions to offer, but I will not increase the length of this communication further than to say, that I think the chances of patent reform would be increased by getting the President and Vice President of the Board of Trade amongst the Commissioners of Patents; and further, that whatever my ideas of the competency of the law officers, as arbiters of patent grants, may be, yet I must protest against their being considered *worse than useless*, as I know of many instances in which their criticisms of the provisional specifications presented to them, have been of great advantage to applicants for patents.

I am, Sir, obediently yours,
F. W. CAMPIN.

156, Strand, Feb. 18th, 1856.

IRISH DECIMAL COINS.

SIR,—In your last number I mentioned the existence of a series of decimal coins, founded on the dollar, retaining the penny as the fiftieth part. I now wish to draw your readers' attention to the existence in Ireland of a decimal coinage formed on the decimal multiples of the penny.

The Bank of Ireland, urged forward by the great want and the depreciated state of the few small silver coins in Ireland, under the sanction of several Acts of Parliament, (Stat. 45 G. III., c. 42; 48 G. III., c. 31; 53 G. III., c. 106; 56 G. III., c. 68,) issued coins (tokens) of the value of 5, 10, 30, and 60 pence Irish. These coins were ordered to be received on payment of the public revenue in Ireland; and to prevent them and the tokens of the Bank of England being re-melted and coined into other silver tokens, such as the shilling and sixpenny tokens issued chiefly in the West of England, about 1816, several Acts of Parliament were passed as (52 G. III., c. 157; 53 G. III., c. 114; 54 G. III., c. 4,) declaring all other tokens illegal; they were even continued as legal tender by the Act (56 G. III., c. 68), at the new silver coinage in 1816, but they were, perhaps, called in by the proclamation of the 1st of March, 1817, though they are not specially mentioned in it, or probably they remained current until the currency of the Great Britain and Ireland were assimilated, on the 27th of June, 1827. The larger coin, of sixty-pence, is exactly like the Bank of England "five shilling piece or dollar," with a new reverse Britannia, and the inscription being replaced by a figure of Hibernia, "the Bank of Ireland and six shillings." The other tokens are inscribed "Bank Tokens, five (10 or xxx.) pence Irish." The dates of those I have seen are, 1804, 1805, 1808, and 1813. I recollect their being in circulation in England, mixed with our current silver money, and called Irish shilling or tenpennies. These coins certainly offered the Irish an opportunity to adopt a decimal system of account, but I have never heard that they availed themselves of it.

It has been often stated that no country that ever had a decimal coinage has resumed their old non-decimal system; a statement only to be explained by the want of knowledge of the subject even as regards Great Britain.

The decimal coins struck for the Sierra Leone Company, (which was established, I find, to encourage trade to Africa, and more especially to find a home for the Negro soldiers who had entered into the king's service in the unhappy American war), have, I believe, entirely fallen out of use in the colony, and we know that the Irish keep their accounts in pounds, shillings, and pence.

The extension of the decimal system on the continent of Europe is almost entirely owing to the desire which Napoleon had, by the means of coin, to perpetuate his personal glory, and also to satisfy the vanity and universalism so prominently exhibited by the French nation at the time of the Revolution. For this purpose the French emperor caried with him a mint, and as soon as a country submitted to his arms, he "reformed" the coinage, imposing on it the French decimal system, and it is curious to see the uniformity and pertinacity with which this idea was carried out. At Baden, in 1808, he made it an article in a secret treaty, that a coin should be struck with his head as Emperor of the Bund; a five-franc was struck (and is valued at 20 pounds sterling), indeed, it is believed that the Grand Duke only struck a single example.—(See *Bonneville, Ency.*, t. i., f. 3.) The system certainly took root in several countries, but then we must recollect that many of the difficulties experienced at its first introduction had passed away, and that at the peace in 1815 it would have been only the recurrence of fresh difficulties and confusion to have returned to the old system.

It was introduced into Venice in 1800; Piedmont (Le Gaule Subalpine) in 1802, and here he named the piece of 20 francs the "Marengo," in memory of the battle of that name, which reduced the Piedmontese to French subjugation; in Switzerland (Helvetic Republic), in 1803; Holland, in 1806, Holland (including Belgium) being a part of France from 1810 to 1814; Westphalia, in 1807, Joseph Buonaparte having coined gold and silver pieces in 1808, 1809, 1810, and 1812. Yet this country at the peace returned to its old mixed currency; so that when we speak of the French system being adopted by Belgium, Holland, Switzerland, Sardinia, &c., referring to the latter period of this adoption, we should consider under what circumstances it had been previously introduced.

J. E. GRAY:

Feb. 15, 1856.

P.S.—I find, on further research, that the United States coined "cents" in 1791, with General Washington's head on them, but I have seen no silver earlier than the date mentioned.

CARPETS FOR THE PEOPLE.

SIR,—With reference to the late discussion on carpets, will you allow me to remark, that, although flatness in design and subordination in colour are, to my mind, essentials to a well-chosen carpet for a richly-furnished drawing-room, yet for the poor, who have no such fantasie, brightness in design appears to me very desirable, viz., something in itself bright and cheering to look at.

In a sanitary point of view I think Kidderminster carpets most objectionable; they are very porous, and after three months' wear the floor beneath will, in towns, be found covered with a thick layer of dust. For the working classes, I think the best carpeting is the best thick felt. These carpets are very easily kept clean, and are quite impervious to dust.

Yours truly,
GEORGE WYLD, M.D.

Proceedings of Institutions.

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LONDON DOMESTIC MISSION READING ROOM.—The annual meeting of this branch of the Mission was held lately, the Rev. W. Vidler in the chair. The room was hung with drawings, banners, and devices, and the chairman, referring to one of the former, a picture of Stonehenge, drew a brief but happy sketch of the progress of the nation, from the period when this structure was reared, to the raising of the Crystal Palace of our own day. He contrasted the products of art and industry displayed in the Paris and Sydenham Exhibitions, giving the palm decidedly to the former; and this fact, he thought, would teach Englishmen a lesson they much needed—humility—and quicken in them a desire to emulate superior excellence. He took the presence of the members there that night as indicating a sense of their own deficiencies, and as evincing also a desire for self-improvement. In these days of many Institutions, no one, having the will to improve, need suffer from the want long. The great evil was, that young people took to knowledge by fits and starts. He begged of them to keep steadily to whatever they undertook, doing it well, and making study an art, as well as art a study. The Secretary mentioned the steady progress the reading-room continued to make; its numbers were still increasing; its income exceeded its expenditure; new books were constantly being added to the library, and more volumes were daily circulated. He spoke of the various classes, elementary and advanced, held in connection with the reading-room, and of the fresh impetus given to them by the proposed examinations about to be held by the Society of Arts. This, he had no doubt, would help to systematise their studies, and direct them to a clearer and better defined object. He spoke hopefully of the improved taste for reading observable amongst the members, and was disposed to look leniently on the prevailing taste for novel reading, deeming it the infant stage of study—the sweet-stuff of literature—and the desire for which would be outgrown by the speedy wish for more solid and wholesome food. He suggested whether a sick benefit society, and a saving fund could not be established in connection with the Institution, to save persons from putting by their money at public houses. About a dozen other members gave short addresses or read extracts from favourite authors. Various pieces of choral and ballad music enlivened the meeting during the evening, and the chairman gave some interesting experiments in the art of electro-plating, showing its advantage over the old plan of washing and gilding. The meeting concluded with the anthem, "Now Pray we for our Country."

SALFORD.—Recently, the second annual meeting of the members of the Mechanics' Institution, was held in the large room within the building, Great George-street, Salford. Mr. G. TEALE, deputy-chairman for the past year, presided. Mr. JOHN URQUHART, the honorary secretary, read the annual report of the directors, which stated that, although the pecuniary position was not so satisfactory as the directors could wish, yet, notwithstanding the great depression in trade, and the dearness of provisions, which had necessitated all classes curtailing their expenditure, the number of members on the books had not decreased, but had been somewhat augmented. Monthly tickets of membership had recently been issued, which it was hoped would induce more members to join. A mortgage of £500 had been effected on the building, to meet the demands on the building fund, and the new directors are recommended to exert themselves for the liquidation of the debt. During the year, 92 volumes had been contributed to the library, which contains 1,850 volumes, and has also the advantage of the itinerating library of the Lancashire and Cheshire Institutional Association. The number of volumes issued to the members during the past year was 2,113 volumes. The news and reading room were well supplied. The president of the institution, E. R. Langworthy, Esq., has promised to provide funds for annual prizes to the various classes. Much attention had been paid to the classes, and their present condition was, on the whole, considered highly satisfactory. The boys' school, under Mr. Angell, has been attended with gratifying success; the attendance at the girls' school had not been so satisfactory, although under an able female conductor. The particulars of the evening classes showed encouraging results. The balance of liabilities on the Institution (exclusive of the mortgage debt of £500) was £139 2s. 3½d. It was hoped that the debt would be liquidated, and that the Institution would be placed in a self-supporting position. The report and the treasurer's statement of accounts having been adopted, Mr. D. CHADWICK, the treasurer, adverted to the importance and value of the classes for promoting elementary education, and expressed his belief that next year they would be able to establish a class for natural philosophy and chemistry. He suggested the organisation of a number of social meetings for rational and agreeable entertainment, as a means of bringing the members together; and a piano, which had been purchased by subscription for the singing class, would be an important auxiliary on such occasions.—Directors for the ensuing year were elected; and thanks were voted to the retiring directors, to Mr. Chadwick, to Mr. Urquhart, to Mr. Robertson, who conducts the mathematical class gratuitously; and to the chairman; and the proceedings then terminated.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 2, General Monthly Meeting.
London Inst., 7, Mr. John Ella, "On Music, Vocal and Instrumental."
Chemical, 8.
Entomological, 8.
TUES. Royal Inst., 3, Prof. Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Mr. W. K. Hall, "On the Causes of the Explosion of Steam-Boilers."
Linnæan, 8.
Pathological, 8.
WED. London Inst., 3, Mr. R. Grant, "On Elementary Astronomy."
Society of Arts, 8, *for Members only*, Mr. C. W. Hoskyns, "The Progress of English Agriculture during the last Fifteen Years."
Geological, 8, 1. Mr. R. N. Rubidge, "Notes on the Geology of some parts of South Africa." 2. Mr. J. W. Salter, "On Fossil Remains in the Cambrian Rocks of the Longmynd." 3. Mr. R. Harkness, "On the Lowest Sedimentary Rocks of the South of Scotland."
Pharmaceutical, 8.
THURS. Royal Inst., 3, Professor Tyndall, "On Light."
Zoological, 3.
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Photographic, 8.
Royal, 8½.
FRI. Botanical, 8.
Royal Inst., 8½, Sir Charles Lyell, "On the Successive Changes of the Temple of Serapis."
SAT. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3¾.
Medical, 5, Anniversary.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 9th and 11th February, 1856.

Par. No.
Agricultural Statistics (Ireland) (Live Stock)—Return.
Agricultural Statistics (Ireland) (Tillage)—Return.
Fisheries (Ireland)—Report of the Commissioners.

SESSION 1854-55.

511. Railways—Return.

Delivered on 12th February, 1856.

20. Ordnance—Supplemental Estimate, 1855-56.
24. Turkish Loan—Return.
17. Revenue Departments—Estimates.
6. Bills—Local Dues on Shipping, &c.
16. Bills—Court of Chancery (Ireland).
27. Bills—Joint Stock Banks (Scotland).
Wrecks and Casualties—Report to the Board of Trade.

SESSION, 1854-55.

505. Health of the Navy—Statistical Reports.

Delivered on 14th February, 1856.

10. Postal Communication with the Australian Colonies—Treasury Minute.
12. Petty Sessions Clerks (Ireland)—Return.
21. Navy Promotions—Return.
22. Naval Cadets—Return.
25. New Palace (Westminster)—Treasury Minutes respecting Sir C. Barry's Claims.
26. Bullion (Bank of England)—Return.
25. Bills—Medical Profession.
29. Bills—Contractors' Disqualification Removal.

Delivered on 15th February, 1856.

9. District Lunatic Asylums (Ireland)—Treasury Minute.
27. Postal, &c., Communication with Ireland—Treasury Minute.
10. Bill—Prisons (Ireland).

Delivered on 16th and 18th February, 1856.

34. Coinage—Account.
36. Emigration—Return.
17. Bills—Court of Common Law (Ireland).
19. Bills—Juries (Ireland).
31. Bills—Municipal Reform (Scotland).
28. Bills—Church Rates Abolition.
34. Bills—Commons Inclosure.
35. Bills—Drainage Advances Acts Amendment.
36. Bills—Turnpike Trusts Arrangements.
37. Bills—Civil Service Superannuation.
Copyholds—14th Report of the Commissioners.
Inclosure Commission—11th Annual Report.
Tithe Commission—Report.
Army (Crimea)—Copies of Letters by the Earls of Lucan and Cardigan.

Delivered on the 19th February, 1856.

19. Army Estimates.
28. Ramsgate Harbour—Copy of Report, &c.
30. Bill—Justices of the Peace Qualification.

Delivered on the 20th February, 1856.

30. Public Debt—Account.
31. Russian Dutch Loan—Account.
32. Greek Loan—Account.
33. Sardinian Loan—Account.
40. Appointments (Dockyards)—Return.
41. Local Acts—(1, Carmarthen and Cardigan Railway; 2, Cork and Youghal Railway; 3, Deeping Fen Drainage; 4, Dundee Harbour; 5, Ely Tidal Harbour and Railway; 6, North Shields and Tynemouth Dock; 7, Yarmouth and Haddiscoe Railway); Admiralty Reports.
24. Bills—Ecclesiastical Courts Jurisdiction.
38. Bills—Delamere Forest.
39. Bills—Charitable Uses (Amended).
Foreign Office (Examination of Persons—Correspondence.
Australia (Discovery of Gold)—Further Papers.

Delivered on 21st February, 1856.

29. Salt Provisions—Return.
35. Army Commissions—Return.
38. Army Clothing—Return.
39. Trade and Navigation—Accounts (31st December, 1855).
38. Bill—Delamere Forest (Amended), (a corrected copy).

Delivered on 22nd February, 1856.

37. Bank Notes—Copies of Correspondence, and of Order in Council.
49. Admiralty Charts—Return.
4. Bills—Judgments Execution, &c.
28. Bills—Juvenile Convict Prison (Ireland).
Factories—Reports of the Inspectors (31st October, 1855).

Delivered on 23rd and 25th February, 1856.

43. Board of Fisheries (Scotland)—Copies of Reports and Treasury Minutes.
46. Burmese War—Return.
47. Reformatories—Return.
48. East India Judicial Establishments, &c.—Copy of Letters.
52. Military Savings Banks (Crimea)—Copy of General Order.
57. Committee of Selection—1st Report.
54. Corpus Christi College, Oxford—Copy of Regulations and Ordinances.
55. Exeter College, Oxford—Copy of Regulations and Ordinances.
56. Lincoln College, Oxford—Copy of Regulations and Ordinances.
42. Bills—Reformatory Schools (Scotland).
41. Bills—Commissioners of Supply (Scotland).

Delivered on 26th February, 1856.

42. Metropolitan Police—Accounts.
45. Army Commissions—Return.
50. Ecclesiastical Commission (Ireland)—Report.
58. Danish Succession—Copy of the Protocol of Warsaw.
61. Education—Capitation Money—Return.
63. East India (Nawab of Surat)—Copy of an Act.
44. Bill—Aldershot Camp.

Delivered on 27th February, 1856.

301 (1). Trade and Navigation Accounts (31st January, 1856).
23. Bills—Dissenters' Marriages.
32. Bills—Dwellings for Labouring Classes (Ireland).
48. Bills—Carlisle Canonries.
51. Bills—Vice-President of Committee of Council on Education.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette February* 15*th*, 1856.]

Dated 30*th January*, 1856.

254. John Lee Stevens, London—Improvements in doors or apparatus for regulating the supply of air to steam boiler and other flues and furnaces.
255. John Gretton, Burton-upon-Trent—Improvements in brewing.

Dated 31*st January*, 1856.

256. John Stokes, Birmingham—Improvements in fog signals.
257. Henry Holford and Mark Mason, Newton Iron Works, Hyde, Chester—Improvements in machinery or apparatus for compressing metals and for manufacturing all kinds of metallic rivets, bolts, or similar articles.
258. Aubin Emile Coullard-Descos, Paris—Improvements in consuming smoke.
259. James Mash, Manchester—Improvements in working the valves of steam engines.
260. George Napier, Bath-street, Glasgow—Improvements in apparatus for raising, lowering, and suspending boats from ships.
261. Henry Tylor, New Bond-street—Improved joint, applicable to cots, bedsteads, and other frames in metal.
262. John Kinniburgh, Renfrew—Improvements in moulding or shaping metals.
263. Joseph Harrison and John Oddie, Blackburn—Improvements in machines for winding yarn or thread on to spools or bobbins.
264. Thomas Burdett Turton and John Root, Sheaf and Spring Works, Sheffield—Improvements in buffer, bearing, and draw springs.
265. Henry Render, Manchester—Improved lubricating material.
266. Frederick Kersey, 5, Laurie-terrace, St. George's-road, Southwark—Improvement in the manufacture of drain pipes.
267. George Hallen Cottam and Henry Richard Cottam, Old St. Pancras-road—Improvements in folding bedsteads and chairs.
268. John Barker Anderson, East-hill, Wandsworth—Improvements in the manufacture of soap, parts of which improvements are applicable to preparing materials for the purposes of illumination, and also for the purposes of lubrication.
269. Thomas Hurst, Tanner-street, Barking—Improvements in the connecting of the rails or metals generally used on railways.
270. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in gas burners, and in regulating the combustion of gas. (A communication.)

Dated 1*st February*, 1856.

272. Matthew Ker, 8, Cumberland-market—A machine for sweeping carpeted and other floors.
274. Francis Preston, Manchester—Improvements in machinery for shaping and rolling metal.
276. Charles Robert Moate, 65, Old Broad-street—Improvement in securing and sustaining the rails of railways.
278. William Dray, King William-street—Improved cartridge-box and pouch.
280. Francis Best Fawcett, Kidderminster—Improvements in the manufacture of carpets.
282. George Norgate Hooper and William Hooper, Haymarket—Improvements in springs for carriages, and for the cushions of carriages, chairs, mattrasses, beds, and other similar articles.
284. George Duckett, 5, Norfolk-terrace, Westbourne-grove West, Bayswater—Improvements in carts and vans.
286. Charles Catherine Joubert, Rue de Moscow, and Leon André Bordier, Rue de la Ferme des Mathurins, Paris—Improvements in motive-power engines.
288. John O'Meara Beamish, Trafalgar-road, Old Kent-road—Improvement in the manufacture of morocco leather.

Dated 2*nd February*, 1856.

290. John Rock Day, Birmingham—Improved door lock and latch.
292. Benjamin Burleigh, Great Northern Railway, King's-cross—Improvements in certain parts of the permanent way of railways.
294. William Goodman, 6, Canning-place, Leicester—Improvements in machinery for producing knit or looped fabrics.

Dated 4*th February*, 1856.

298. Ralph Waller, Manchester—Improvements in preparing cotton and other fibrous materials.
302. Matthew Whiting, junr., Manning-street, Bermondsey—Improvements in preparing for and in tanning hides and skins.
304. Nathan Agar, Upper Ebury-street, Pimlico—Improvements in connecting spindles of locks and latches with their knobs and handles.
306. Thomas Mills, Leicester—Improvements in machinery for the manufacture of looped fabrics.

Dated 5*th February*, 1856.

308. Frans Victor Oscar Hyckert, Paris—Improvements in heating.
310. Michael Leopold Parnell, 283, Strand—Improvement in the construction of locks.
312. Francis Montgomery Jennings, Cork—Improvements in bleaching vegetable fibres.
316. Thomas Williams, Clerkenwell—Improvements in omnibuses.

Dated 6th February, 1856.

318. George Napier, Bath-street, and John Miller, Cavendish-street, Glasgow—Improvements in the mode of driving and in applying screw propellers to the propulsion of vessels.
320. John Dodgeon, Burnley, and James Wilson Bateson, Rawtenstall—Improvements in looms for weaving.
322. John Inshaw, Birmingham—Improved pressure guage.
324. Charles Victor de Sauty, St. Mary's-terrace, Walworth—The prevention of the leading or fouling of fire-arms.
326. Franklin Prestage, Wylye, Heytesbury—Improvements in locomotive engines.
328. Charles Frederick Philipp Funcke, Herdecke, Westphalia—Improvements in tanning skins and hides.

Dated 7th February, 1856.

330. Richard Bleasdale, Rochdale—Improvements in the machines for spinning called throstles.
334. Henry Berlette, Boulogne-sur-Mer—Improved apparatus for roasting coffee.

INVENTION WITH COMPLETE SPECIFICATION FILED.

345. John Wallace Duncan, Grove-end-road, St. John's-wood—Improvements in or connected with apparatus for the generation and application of steam for impelling purposes.—9th February, 1856.

[*From Gazette February 22nd*, 1856.]

Dated 17th January, 1856.

156. Samuel Ratcliffe Carrington, Stockport—Improvements in the manufacture of hats, and in machinery or apparatus connected therewith.

Dated 1st February, 1856.

271. Allan Macpherson, Brussels—Improvements in obtaining and applying motive power. (A communication.)
273. Edward Schischkar, Halifax—Improvements in dyeing and colouring wools, hairs, silks, yarns, and textile fabrics made of the same materials either wholly or partially.
276. George Holcroft, Joseph Smith, and Thomas Holcroft, Manchester—Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.
279. Andrew Lamb and John Ronalds, Southampton—Improvement in the construction of iron ships, boats, and other similar structures.
281. Henry Bestwick and Joseph Bury, Manchester—Improvements in cocks, taps, or valves.
283. James Timmins Chance, Birmingham—Improvements in furnaces used for flattening glass.
285. Auguste Eugène Dannequin, Rue de l'Echiquier, Paris—Improvements in caoutchouc or any other waterproof garments.
287. Benjamin Franklin Miller, New York—Improvements in ventilators for chimneys and other purposes.

WEEKLY LIST OF PATENTS SEALED.

Sealed February 15th, 1856.

1861. Charles Rowley.
1873. Edward Heys.
1875. Robert Crawford.
1897. Dupont de Bussac.
1909. Joseph Gilbert Martien.
1949. Richard Archibald Brooman.
1986. Edward Greene Jones.
2018. Charles Pryse and Paul Cashmore.
2044. Jean Panet.
2141. Etienne Laporte.
2357. Henry Woodrow.
2493. Samuel Cunliffe Lister.
2508. Charles Marie Pouillet.
2512. Henry John Betjemann.
2581. George Tomlinson Bousfield.
2671. Charles Rice.
2673. Charles Rice.
2812. Thomas Rickett.
2864. Hiram Hyde.
2889. Dundas Smith Porteous.

Sealed February 19th, 1856.

1891. John Cornes.
1893. James Orange.
1895. Edward Field.
1898. Charles Van den Bergh.
1906. Charles Claus.
1911. William Lynall Thomas.
1922. John Avery.
1924. John Avery.
1928. Charles Frederick Stansbury.
1930. Adam Hall Hardy and Jacob Hardy Fordoff.
1993. George Hearnden Golding.
1994. George Hearnden Golding and Thomas Paine.
2004. Augustin Morel.
2100. Auguste Edouard Loradoux Bellford.
2204. William Ramscar.
2442. Auguste Edouard Loradoux Bellford.
2656. Denis Jonquet.
2830. William Henry Newman.

Sealed February 22nd, 1856.

1901. Jacob J. Lownds.
1903. Jules Theodore Alexandre Zinkernagel.
1905. Wright Jones.
1915. William Wood.
1923. John Avery.
1925. John Avery.
1927. Charles Frederick Stansbury.
1929. Eugene Carless.
1945. Auguste Edouard Loradoux Bellford.
1961. John Juckes.
2043. Eugène Grenet, jun.
2047. Edmund Sharpe.
2073. Jean Pierre Garbal.
2091. John Gray, M.D.
2171. Joseph Mitchell.
2189. Franz Uchatius.
2593. Joseph Denton.
2637. Charles Tennant Dunlop.
2697. Alfred Vincent Newton.
2753. Rudolph Bodmer.
2775. William Norton.
2779. Robert Adam Whytlaw.
2801. Alfred Vincent Newton.

Sealed February 26th, 1856.

1933. Celse Eugène Capron.
1935. Thomas Alexander Cooling.
1936. Charles Humfrey, jun.
1938. James Smith.
1942. Charles Humfrey, jun.
1948. Edward Newman Fourdrinier.
1966. Rudolph Schramm.
1980. William Smith.
1982. Alfred Heaven.
1996. William Woodcock, Thomas Blackburn, and James Smalley.
2029. William Armand Gilbee.
2026. John Stewart.
2102. Richard Archibald Brooman.
2124. Ursurer Joseph Brasseur.
2150. Thomas Deakin.
2166. Robert Robey and George Lamb Scott.
2726. William Foot.
2792. Jacques Elidat de Malbec.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

February 11th.

396. William Blissett Whitton and George Samuel Whitton.
1195. Moses Poole.

February 12th.

437. Wright Jones.
557. Thomas Wells Cross.
666. William King Westly.

February 13th.

381. Peter Armand le Comte de Fontaine Moreau.

February 14th.

413. James Murphy.
418. Thomas Clark Ogden and William Gibson.

February 15th.

390. Benjamin Greening.
407. John George Perry.
421. Charles Watt and Hugh Burgess.
476. John Grist.

February 18th.

434. Charles Nightingale.

February 19th.

456. Edwin Stanley Brookes and Joseph Black, and George Stevenson and William Jones.

February 20th.

438. Samuel Rodgers Samuels and Robert Sands.
445. Thomas Bell and Richard Chrimes.
467. William Johnson.
469. Thomas De la Rue.
677. George Ross.

February 23rd.

482. John George Taylor.
491. Lord Berriedale.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3810	February 15.	Travelling Bottle and Glass	P. and F. Schafer	12, Brewer-street, Golden-square.
3811	February 18.	Fishing Winch Reel with Check	Frederick Allies	Worcester.
3812	February 27.	Improved Cap for Travelling Bags	Seth Dixon and Edmund Eyres	17, Savoy-street, Strand.

Journal of the Society of Arts.

FRIDAY, MARCH 7, 1856.

TWELFTH ORDINARY MEETING.

Wednesday, March 5th, 1856.

The Twelfth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 5th inst. H. R. H. Prince Albert, President, in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Bagnall, Charles
Benson, Samuel S.
Brown, Thomas Jonas
Dell, William
Hall, John Paxton
Jones, Charles T.
Jones, John
Langston, James Haughton, M.P.
Milligan, Robert

The paper read was

THE PROGRESS OF ENGLISH AGRICULTURE DURING THE LAST FIFTEEN YEARS.

By C. W. Hoskyns.

A very acute observer of the minor experiences of life has left behind him the remark[*] that no subjects are so difficult to handle as those which are of every-day interest, and come under the definition of common property.

A very strong sensation of this truth came over my mind on being honoured by the request of the Council of this Society to undertake a paper on the recent progress of Agriculture as one of its evening topics for discussion. There is no branch of our industry to which the remark I have quoted applies so forcibly; and if it were not that the most difficult tasks and the most discouraging results I have ever met with have been from my own soil, I should never have had the courage to undertake the task, nor that deep interest in the topic which makes pleasure vault over difficulty, and enables hope to look discouragement in the face without flinching. In fact, if I am not so much afraid of it as I know I ought to be, it is because, with the everlasting exception of my own farm, my agricultural experiences have not verified that stubbornness and tenacity which we used to hear of, but, on the contrary, every idea or suggestion forced out by the reflections that accompany a difficult practice have generally met with a freedom and openness to conviction which of itself has seemed to me to mark a sort of agricultural era, and has led me to watch with a wider interest its cotemporary development throughout the country.

Yet in doing this, and looking back upon its past history, I cannot deny that the comparative universality I have alluded to, of the topic, has appeared in some degree to lay it open to the adage that "what is everybody's business is nobody's business," diverting the eye of public interest from the landmarks of its progress by the very breadth over which its current extends; whilst other industries and arts, lying in more defined channels, are more readily marked and measured, and every invention and improvement mapped down with a precision, not so easily accorded to the progress of a national industry, which, though representing an invested capital calculated, twenty years ago, at £217,000,000,[*] has, for the reason suggested, reached our time with no history, no statistics, no representative in the law or the state, no board, no minister, no department, in fact, as Mrs. Gamp would say, "no nothing." So entirely unnoted and unchronicled is its progress, by the state for the public, or by the public on its own account, that if it were possible for me to recapitulate step by step all the forgotten facts of its history during the present century alone, and lay them succinctly under the eye, I do not believe there is a single branch of art or industry of which the particulars would seem to form a more novel or eventful history, or more suggestive of surprise that they should have been allowed to drop astern, as it were, in the wake of time, and fade from view; and this, too, while presenting facts surely as instructive for reflection, or foresight, as could occupy the attention of the economist or the statesman.

Before enlarging on its more recent progress, it seems desirable to premise some statement of the condition at which it had arrived at the opening of the period under review. To form a judgment of the growth one must know the original stature. For this purpose I must hasten over some ground familiar, probably, to many of my hearers.

I need hardly point to the fact that this country, whose average imports are now nearly ten million quarters annually, was, less than a century ago, doing a large trade as an *exporter* of corn to other countries; that later in the last century than the year corresponding with this, a celebrated French economist (M. D'Angueille), quoted afterwards by Arthur Young, said that England could grow corn enough in one year to support herself for four. The twenty years elapsing between 1773 and 1793 were the turning point of our history in this respect, a sort of pivot period, when exports and imports nearly balanced each other, under almost nominal duties inward and outward. A slow but steady inclosure of land during that interval, began to mark the consumption of a gradually increasing trade and population, of which, however, we have no accurate means of computation or comparison till the opening of the present century. I may just mention that throughout that unique period of twenty years the price of wheat averaged with great steadiness about 45s. per quarter in the money of that day, when rents were from 7s. to 10s. per acre, which afterwards rose to from 30s. to 40s. Thus in the memory of men now living, the price of a bushel of wheat was two-thirds of the rent of an acre of land, not at a time of any severe pressure of war or scarcity, but under circumstances of comparative equability. It would be difficult to adduce a more striking evidence of the fall in the price of food as compared with the producing area, than the change that has since taken place.

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[*] "*Difficile est proprie communia dicere.*"—Hor.

[*] Mc Culloch.

With the year 1793 this period terminated, and, with the war, began also a succession of deficient harvests. No account had been kept of the progress of inclosure during the century; but a Committee of the House of Commons which sat in 1797 computed the total quantity at about four million acres.

From the commencement of the present century, down to this time, we have a definite record of the progress of inclosure, of population, of corn imported, of prices, and, in some measure, of the rent of land; and from these we shall be able to form some idea of the point to which our agriculture (using the term in its national or territorial sense) had arrived at the period which forms the starting point of our present inquiry.

Taking it in decennary periods, the account stands as follows:—From 1800 to 1810, the quantity of land enclosed was 1,657,980 acres, the increase of the population of Great Britain 1,506,687, and the quantity of wheat imported 6,009,468 quarters.

In the second decade, from 1810 to 1820, the inclosure was 1,410,930 acres, the further addition to the population 1,978,523, and the wheat imported 4,585,780 quarters.

Thus, during these first twenty years, while upwards of three million acres were brought under the plough, the population was increased about three-and-a-half millions. The rent of land advanced during the war to at least three times its former amount, measured at least in a depreciated paper currency. But with the close of the war, in the middle of the second decade (1815), the average price of wheat given by those fifteen years, 84s. 9d. a quarter, fell to an average of 78s. 4d. for the last five years of the same period.

These twenty years, therefore, present to our view the phenomenon of immense inclosure of land, under the stimulant of the highest prices of food ever known, except in very early recorded cases of famine, in this country. It would seem to have required no prophet to foretel the collapse that must occur when the stimulating causes were withdrawn, with the increased acreage brought under crop; yet it does not appear that this was the point that drew chief attention in the remedial measures proposed, the tendency of which was rather adverse than favourable to the laying down of land to its original pasture.

From that time—viz. 1820—the whole scene changes, and the most trying period commenced that the business of husbandry has perhaps ever known in this country; the causes of which are now more clearly apparent. Three million of fresh acres, not of the best quality, as the land last brought into cultivation in an old-inhabited country rarely is, and a circulation suddenly contracted to a metallic currency, produced a condition which no prohibition of importations was of any avail to remedy, because the competition lay, in fact, at home, in that increased acreage, held at greatly advanced rents. Nothing but the *steady increase of population*, and the still more rapid increase of trade and capital, could have sustained cultivation at the point it had extended to, nor was this done without considerable reduction of rents, though to nothing like what they had been before the war.

The best expression of this is seen in the strikingly reduced inclosure of the next ten years (from 1820 to 1830), which reached only 340,380 acres, little more than a fifth of the previous rates. During this third decennary period, the advance of the population by 2,161,495 was gradually bringing round the natural remedy to the farmer for those overdoses of inclosure which the war had prescribed; but the reduction of the average price of wheat from 78s. 4d. to 58s. 3d., accompanied by no increase of importation, shows an advanced acreable produce under a strong home competition; the rent of land gradually rising to nearly its previous mark.

The next decennary period, from 1830 to 1840, shows, in spite of the facilities afforded by the GENERAL INCLOSURE ACT OF 1836, a still reduced and almost trifling addition to the cultivated soil amounting to only 286,070 acres, less than a sixth of those first named. Still, though there were 2,249,648 more mouths to feed, and the importation, though increased, was not large, the average price again fell, to 57s. the quarter, disclosing a still further increased acreable produce against the advancing numbers.

The summary of the whole four decades, then, from the beginning of the century to the year 1840, exhibits on the one hand an addition of rather more than three-and-a-half million acres to the cultivated land, against an increase of nearly six million to the population of Great Britain; whilst the effect of the foreign supplies of wheat did not amount to so much on the average as *three weeks' consumption* in the year, calculated over the whole period.

It may be remembered that at the time when the question of the free admission of foreign corn was in agitation, it was a common prediction that it would have the effect of throwing land out of cultivation. It will be seen from the preceding account of the immense inclosures during the first twenty years of this century, that had the measure taken place at the close of that period, there might have been some ground for the apprehension on the part of the inferior undrained clays, from the fact that the increased produce, shown by the figures I have given, was chiefly drawn from a remarkable cotemporaneous improvement going on, I might almost say discovered, in the cultivation of the *lighter class of soils.* But it is equally evident, from the same figures, that from 1820 to 1840 not only was this prediction becoming every year less applicable, but, on the contrary, we were beginning to present the opposite condition of a population overtaking the resource of fresh inclosure, and compelled to have recourse to some other means for increasing the produce of the soil.

It is at this period in the history of a country that agriculture begins to assume the most interesting aspect for the purpose of our present inquiry. It is quite obvious that until this pressure arrives, until the tide of population has so risen as to cover that outlying margin which fresh inclosure brings under the plough, the mere routine of practice is not likely to offer much change, or to undergo much intrinsic improvement. As long as the deficiencies of acre No. 1 can be supplied by a mere collateral resort to acre No. 2, the same system will do, the same old implements, the same waste of manure, the same uneconomised apparatus in the field and in the fold, in the barn and in the cowshed, in the dairy and in the piggery, for the simple reason that the second inclosed acre is open to precisely the same process as the first.

But it has been and is the characteristic of our day to have witnessed in this country the comparative exhaustion of this resource. The plough can no longer strike a supplementary furrow in fresh ground; and we have seen, during the fifteen years that have elapsed since 1840, the first fruits of that opening problem, how the old furrow was to be made the arena of an increased produce, when agriculture is thrown back upon its own resources, and compelled, somewhat tardily at first, to examine those resources by the light of its principles.

No doubt this condition may have befallen other countries; perhaps in the Netherlands and in Tuscany, not to name any other, something of the same kind in the exhaustion of territorial resource may have been presented; but certainly never before in any country possessing such characteristics as this in point of capital, inventive power, industry, and skill; and there never perhaps has been a more remarkable exemplification of the proverb—that "all things are double, one against another"—than in the timely elements that seemed to spring up just when our husbandry had come to need them, more than it was, so to speak, itself aware of.

I allude to four distinct elements of new resource opening to view for the first time, almost simultaneously, about the year 1840, and which, for reasons that will presently appear, I will state in this order:—First, the introduction of the use of Guano; secondly, the publication in this country of the works of Liebig; thirdly, the establishment of the Royal Agricultural Society of England; and fourthly, the introduction of an improved system of Drainage.

My hearers will perhaps draw rapid mental conclusions on the comparative practical value of these four farmers' friends. No doubt guano is a ready friend, and a quick teacher. But who is there that does not remember the almost universal error that guano brought to light, existing in men's minds as firmly rooted as a first principle, respecting the food of plants and the nature of manures? Who cannot recal the shakes of the head with which 'practical men' pronounced condign judgment upon guano, with the hundred 'artificials' that sprang up after it, as being a mere 'stimulant,' forcing a single crop by some sort of magic, and then leaving the ground no richer than before? The very objection was a challenge, which cried out for an answer as plainly as matter could appeal to mind for explanation. The manure was come, "and the man" was needed to answer that challenge; and the man was found in the distinguished Professor, then of Giessen, whose publications, if they did not initiate, at least drew attention to, the important and new-sounding fact that the bulk of a plant being not derived from the soil, the bulkiness of a manure had little to do with its value. Let us give the honour due to our first great teacher, Liebig; though it still remained for us to learn a deeper lesson from a quarter nearer home. But this expression regarding 'artificial' manures, that they were 'mere stimulants,' was an error not in husbandry only, but in physiology. The analogy which the phrase assumed, from animal to vegetable life, was false. You cannot 'stimulate' the growth of a vegetable except by supplying it with its natural food; and whether that be conveyed to it condensed into half a bushel, or disseminated through the mass of a cart-load, the elements it feeds on are identical in either case, and the growth and substance produced are the same. It has pleased Creative Wisdom to adapt certain herbs and minerals to the faculty of producing upon the brain and nervous apparatus of *animal* life sudden and temporary exaltations of power and feeling, to meet the sudden emergencies to which animal life is subject from without; and these exaltations are followed by an equivalent depression. But no such necessity, and consequently no such capacity, exists in vegetable life. LIGHT is, in fact, in their case, the only thing to which the term 'stimulant' can, for want of a truer expression, be applied. Whatever promotes their growth is their *specific food;* and the more readily and completely a manure yields itself wholly up to the crop it is applied to, the more effectually it obeys the farmer's purpose, by the quick return of his capital, and the production of an ample supply of manure for the coming year, from the consumption of the crop that has been obtained. Mr. Lawes put this truth into few and striking words, when addressing the party assembled last year at the presentation of his testimonial Laboratory. "It is sometimes said," observed he, "that farm-yard manure possesses an advantage over artificial manures in its lasting qualities. This is a fallacy. The lasting qualities of farm-yard manure are (in a commercial sense) not an advantage; for it is getting back your money by instalments instead of getting it all at once. A great deal of your capital is placed in the land, where it lies dormant for a long time; but science can correct that evil by enabling you to put *the right manure in the right place.*"

I have ventured into this point so far, with the view of showing what a happy collateral commentary upon the introduction of guano were the translated works of such a writer as Liebig, who, whatever his after-suffered breach at certain points, when exposed to the formidable battery of such experimentalists as Lawes and Gilbert, had yet probed into nature's secrets and disclosed the theory of the action of manures, and led to that economy in the *special* application of them to different crops, the effect of which has been to institute a new business and establish a new Manufacture in this kingdom. What would our ancestors have said to the manufacture of an *artificial manure?* Thirty years ago, the phrase would have sounded about as rational as the idea of manufacturing a wheat-rick. Yet this is now a large trade ancillary to agriculture, employing thousands of hands, and proceeding upon chemical data that, before the investigations of Professor Liebig, were like an unknown tongue to the agriculturist. The very advertisements of such traders, puffing and exaggerated as they may often be, have had the effect of engrafting into the language of this new agricultural commerce, words and phrases which incidentally assert scientific facts, and involve a sort of rough introduction to the meaning and use of chemical terms for those who would, probably, obtain it in no other way.

There is nothing more remarkable than the rapidity with which the smallest morsel of practical truth, however scientific in its nature, becomes snapped up and digested into the language of commerce. The late Charles Buller used laughingly to say that the *Times* advertisements were the best light reading he knew for amusement and instruction at short notice. I often think of his words when I see the practical doses of chemistry administered to modern husbandry in the weekly advertisement pages of our agricultural periodicals. The revolution, perceptible *to the ear,* that farming has undergone from such causes, strikes me, in truth, as a 'great fact,' so gradually grown up, that it is only by certain landmarks laid down by accident, or by some of those irresistibly ludicrous mistakes which the use of new terms brings to pass, and stamps upon the memory, that one can measure the change wrought in this particular. What a long-winded sentence it used to take, for instance, to paraphrase and explain the now well-known word Ammonia, in order to rescue that all-essential 'chemical' from a certain personality of attribute which its feminine termination inconveniently suggested; and what would now be thought if my friend Mr. Paine, of Farnham, in contrasting the geological wealth under the soil with the fertiliser just named existing in the atmosphere above it, —describing, in fact, the fossil dung which he "digs out of the bowels of the harmless earth," and of its antediluvian live-stock, should narrowly escape, as Mr. Huxtable did some ten years ago, being reported as introducing *coppery Lights* into the dark places of agriculture! I can hardly forgive myself for having dropped an extinguisher on those metallic luminaries, which caught my eye in a version of a speech that chanced unluckily to come across me before publication, with that now well-known mineral super-phosphate, the Coprolite, thus brilliantly introduced to the farming world. But to return.

The third element of progress I named was the establishment of that powerful engine of agricultural improvement, combining both the stationary and portable character, the Royal Agricultural Society. If I were asked to name, in a breath, what I regarded as the greatest achievement of that important body, I should say that, like Aladdin's lamp, it has summoned up a new race of potent Genii, and set them all at work for the farmer. If any one doubts that fact, let him contrast the Exhibition of Agricultural Implements collected by its first Meeting, in 1839, at Oxford, where the entries were twenty-two, with that which took place in 1852, at Gloucester, where they amounted to no less than *two thousand and thirty-two!* What would have been thought only ten or twelve years ago, of the facts disclosed in letters received last year from several of the great firms of English agricultural machine makers, whose engines we were unable, for lack of space, to select for the Paris Exhibition, viz., that being in the habit of exporting from *one to two hundred agricultural steam engines* a year to different parts of the Continent, the non-appearance of one of their manufacture amongst the prize engines in the French Exhibition would operate unfavourably to them with their foreign connection. And these, be it noticed, were the "*un*successful candidates," the less brilliantly distinguished amongst the decorated throng of prize and medal winners. Such a fact speaks volumes. As it was impossible, of course, to accommodate all, in the space allowed us, of 4,000 square yards, in the Exhibition, the only thing left was to 'bear it in mind,' which I have done ever since, and now beg to offer it as a specimen "highly commended."

The fourth element I named was Drainage. To this I shall have to return.

I refer to these four prominent agencies, presenting themselves to our review, as cotemporaries, not in the tone of an exclusive citation of particular causes, for the causes co-operating with them have been many, much less with the object of stringing upon them a dry chronological narrative of facts. The use of the past does not lie in its catalogues of annual occurrences, little better for our purpose than an almanack or obituary. The review that gives back life and value to bygone events consists in their analysis, for present information and future guidance; and, following that vein of thought, the causes I have named as dating their origin about the same period (1840), suggest to mind the two great heads into which agricultural improvement naturally mainly divides itself—viz., the Chemical and the Mechanical. And I confess that when I see the extent to which the use of 'chemical manures,' so to call them, has been carried upon the light turnip-husbandry soils—upon those vast Norfolk plains, for instance, which the names of Holkham, and West-acre, and Castle-acre, bring to mind; where the manure-merchant is the largest landlord, amongst the large, and the heaviest rent his 'little bill,'—I cannot help identifying those two divisions I have named, with the two classes of soils which form almost separate codes of agricultural practice in this country, and whose history and experiences are so widely different—viz., the Light soils and the Clays.

It must be obvious to any one who considers the nature of our climate, that the treatment of the heavier and more tenacious soils presents by far the greater difficulty, and one that would be the latest surmounted in the natural progress of labour or invention. But the mechanical disadvantage presented by the clays is not the only one, nor the worst. Few men prefer a difficult task to an easy one. Few men, under a weeping sky, prefer a soil which is for ever turning rain into a foe, to one where it is not only a friend, but an ever welcome one. Few men prefer a soil upon which, whatever its boasted mineral superiority, that "beast with golden feet," as the Sheep is called in the Persian proverb, gets its four golden extremities screwed into the ground, like the table of a ship's cabin. The consequence is, that we realise upon the clays a sort of travesty of the saying of the old poet, who says that "Love alights with ease on wealthy places."[*] We find, conversely as it were, that "Wealth alights with love on easy places"—in other words, that every farmer who has capital enough to manage a clay farm in a capital way, goes travelling about in search of "a sheep and turnip farm." In the track of capital follows, I fear, the main average of intelligence and skill, settling, like the Monks of old, upon the choicest spots, where the struggle with Nature is not only lighter, but spreads its easier task over a *longer* and more leisurely year of *twelve* uninterrupted months. The statistics of the rain-fall of this country, of which, happily, we *are* in possession, show that the quantity of rain which falls in the west of England is nearly twice as much as in the east, and that the farmers of the midland and west-county clays have thus had another disadvantage to contend with in their plough-lands; and that the causes which, in the early part of this century, occasioned so much land, which formerly was pasture, to be broken up for corn, in those districts of the kingdom, bequeathed for many years a forced application of the soil, not easy to correct without too long-continued a loss for tenant-farming to encounter. Stiffer land, more rain, a shorter working year, less capital, with its too frequent concomitant, less skill and intelligence, present a formidable array of disadvantages against the heavy soils, in taking a comparative review of our means of advancement. To this the one reply has been, Drainage. But if the drainage statistics are only half true, which we heard read in this room not many weeks ago, the advanced knowledge of this art has sadly outstripped the practice, and what has been done is little compared with what remains to do. What are two or three millions, or five millions, of public money spent in drainage? Would *one hundred* millions drain, at £4 or £5 an acre, all the clay soil, pasture as well as arable, in Great Britain, now undrained or badly drained, and the draining of which would pay 10 per cent. and 20 per cent. upon the outlay? What *can* be the cause that,—in a country which has sunk nearly its three hundred millions sterling upon railroads, that scarcely pay back their 3 per cent. upon the outlay,—stints and diverts the free flow of capital from a channel as safe, as certain of return as the arterial blood, to the heart and inner sustenance of the nation?

That this is a matter involving serious points of consideration will, I think, appear from the following facts:—

During the seven years from 1840 to 1846 inclusive, our imports of wheat had advanced from less than one million quarters per annum in the previous ten years to very nearly an average of two millions; while from 1846 to the present time, under the development of an unrestricted trade, they have advanced to nearly *five million* quarters per annum, or more than half of the whole imports of foreign grain. Now, inasmuch as the wheat crop occurs only once in the four-course system of the Light soils, whilst upon the clays, whether managed upon the six-course system or upon the older three-course shift, it is grown upon a larger oddmark, approaching to the ratio of a *third* instead of a *fourth* of the arable land, and is, therefore, looked to by the farmer as furnishing the profit, which on the light soil is drawn from the wheat and barley crop together (besides a wider range of profits derived from the sheep flock): it seems obvious that the improvement of the clay soils to their utmost extent is the special, I should almost say the only, means left to us for operating in any important degree to maintain the produce of wheat in proportion with our increasing numbers.

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[*] Soph. Antig: 582.

The population of Great Britain at the last census in 1851 was twenty-one millions; during the five years ending with that year, the imports of wheat had averaged four-and-a-half million quarters, thus giving about eleven weeks' consumption instead of three weeks, the quantity I named as supplied by importation during the first forty years of the century. But, it must also be borne in mind, that not one quarter of imported corn do we obtain except by its equivalent in additional labour at home, the wages of which will still be mainly spent in the purchase of fresh supplies of food; whilst, therefore, the extra demand is so far cumulative, the home grower can only avail himself of it by meeting it with an extra produce obtained from the soil at the same cost. We have here indeed a challenge to the improvement of the wheat soils. Drainage first, and some new mechanical aid not yet divulged, are the only resources we can look to with reasonable prospect of success.

It would be, beyond all expression, interesting, if on looking back over the last ten years of increasing population and enormously increased imports, we had any possible means of ascertaining the statistics of our increased home produce; but for this invaluable retrospect we are without the shadow of progressive data. The weekly returns of corn sold, which regulate the averages, are too imperfect and manifestly untrustworthy to be even worth alluding to; and beyond these we have literally nothing approaching to a guide to go by; all we can do is, to look at our improved implements of husbandry, and their immensely increased sale, indicated by an annual exhibition augmented a hundred fold, from *twenty* to *two thousand*, as a subject of indefinite congratulation, which it is out of our power to estimate, as we should like to do, by an annual table of recorded results. This would be a practical and complete test. But instead of this, we are in the position of a Manufacturer who shews you the quantity of fresh machinery he has put up, the new inventions he has made or purchased, the extra hands he employs, the increased number of his customers, and the superior economy with which his work is accomplished, but can furnish you with no account whatever of the produce! Whoever wishes for an almost provoking argument for agricultural statistics, let him look at this now irreparable fact. In vain do we point to the almost perfected specimen of the Plough, from the manufactories of a Ransome, a Howard, a Ball, or a Busby; to Garrett's horse-hoe; to Hornsby's drills; to Benthall's broadshare; to Coleman's cultivator and scarifier; to Chandler's ingenious water-drill; to Croskill's clod-crusher; to the nearly, but not quite, perfected Reaping machine; to our splendid late improvements in steam-driven barn-works, completing at once, and in the compass of a stage-wagon, the whole operation, from the thrashing of the corn to the dropping it into the sack, winnowed and cleaned, and ready for market, recalling, to the above distinguished list, the names of Clayton and Shuttleworth, Exall and Andrews, Humphris and others. These names are but a few even of the most prominent among an army of Titans eternally waging peaceful war, whose machines, like a "list of the running horses," at our annual agricultural Olympics, approach each other within the narrowest shades of differing merit. We witness all these fresh accessions of mechanical economy to the various details of husbandry practice, but what their joint comparative effect *has been* upon the national produce we cannot tell, and, what is worse, shall never know. But this we are able to see, that, with the exception of the inimitable Clod-crusher, almost every mechanical improvement I have named is, more than at first meets the ear, addressed to light land culture. First, because a great proportion of them are adapted to the larger holdings, more rarely met with on the clays. But let me take, for instance, that useful class of instruments represented by Benthall's and Coleman's scarifiers for *Autumn cultivation of stubbles*, one of the greatest improvements of modern practice. The farmer of the clays may listen with admiring envy to the virtues of an instrument whose wholesale power of extirpating the annual weed crop bids fair to reduce the Bare Fallow to its narrowest necessary limits, but in the majority of seasons he dare not use it. The utmost exertion of his team is required to get his ploughing done, and his wheat sown, in the few weeks after harvest when his land is in proper condition for tillage. Had he but an implement that would work *night and day* during those critical six weeks of September and

October after his grain is harvested, and before the November fogs and rains set in, he would, indeed, be a debtor to mechanical skill; but the want of this leaves him often overtaken by the approach of winter, with many a task unfinished that comes with redoubled pressure upon the hurried days of Spring-time. I say that this is the specific want upon that large portion of the arable land of this kingdom which the character of our climate renders unfit for winter cultivation. The effect of drainage, even when most perfectly performed, is only comparative. It modifies the evil, but does not cure it. "We have scotch'd the snake, not killed it." Besides, the glazing passage of the plough through a clay in winter time is often detrimental to the operation of the drains; and the elongation of the modern mould-board, one of the features of its improved form, is an elongation of that glazing action, showing that even its very points of excellence and finish—for light land culture—are, to some extent, negative upon the clays.

Unless the mighty power of Steam will befriend us here, I see no loop-hole of escape from the unequal struggle which has been going on, and is every day widening the distance, in the race between the light soils and the heavy. The resources of the light soils are more readily available, and *followed out through the year*. The turnip crop, fed off by an ample sheep flock, with the collateral advantage of the barley crop, renders their quadrennial wheat-crop a thing of almost attained excellence, whilst, in their case, of far different comparative importance to the place it holds upon the clays.

I do not deny that, when I look at the new and extraordinary powers which the use of guano holds out to the heavy land farmer, and not guano alone, but every artificial fertiliser which, like it, can be *applied by hand to the growing crop*, leaving no track of horse or wheel, during the wet months of winter, and rendering these naturally rich staples almost independent of "courses" and "shifts," as they are called, I see a power of almost indefinite increase in the wheat crop (for whose enlargement we must look to that quarter), could we only overcome the mechanical difficulty, the two-fold problem of hard work and shorter time, in their preparation. That it can be overcome I do believe; that it is worth the effort, not only of a Company, but of a Nation to overcome it, I foresee. To no other country is the problem presented, under the necessity which enforces and *compels* its consideration and solution upon our large acreage of clays, with such a weeping winter sky above them, yet such inexhaustible capabilities within them. The celebrated seven-acre field at Rothamsted, and that perplexing Eden of mystery at Lois Weedon, differing in other aims, agree in this, in showing the unfailing annual produce which a wheat soil, *unmanured*, will give, *according to its tillage*, if kept free from weeds.

What, then, might not be accomplished on the clays, if, to a more specially adapted mechanism of tillage, we should add the revision and partial abrogation of an ancient system of cropping, and covenants for cropping, which the introduction of Guano has, to a great extent, rendered obsolete. When we consider the primary rank of the wheat crop as the direct human food, and the peculiar capacity of the Scotch and Irish climates for the production of oats and other inferior grain, evinced in the statistical returns that have appeared of those parts of the United Kingdom, is it not forcibly indicated that no blind adherence to custom, or rotation, should prevent our stronger class of soils being put to their full capacity, being *worked on high-pressure?* Nor can I see why the farmer of the clays should be forbid to do as the manufacturer does,—adapt his produce to the market, and turn guano into wheat as fast as the machine he hires will enable him. The idea of "exhaustion of the soil" is a chimera. Let it be only kept free from weeds, the true exhausters of land, and the simple equation remains, that so much applied Nitrogen* will produce so much Wheat, and, when that is reaped, and the land is ploughed and cleaned, the same dose of nitrogen will occasion the same result again. If the question be still asked, what chemistry has done for agriculture? let the most original and practical authority in this or any other country on that subject, Mr. Lawes, point to that simple fact which he has discovered and proved. The controversy which has made this important discovery memorable, has had the singular fate of outlasting its field-proof and practical adoption in this country. 'Nitrogen for wheat, and phosphates and sulphates for turnips,' has received the stamp of successful practice, before the battle of theory has been brought to a close. But Chemistry has a fair right to its *Retorts;* and it would be ungrateful to suppose that our debt to Professor Liebig is cancelled or affected by the practical disproof of his opposite theory, whose original announcement, regarded as part of a grand research into the principles of manure, awakened attention and investigation to the point, and has thus conferred such lasting benefit on agriculture, "bringing, with its surcease, success." The experiments, too, of Mr. Thompson and Professor Way, resulting in the discovery of a specific chemical relation between ammonia and the silicates of alumina, have strengthened our practical reliance on an affinity, the importance of which, in the culture of clays, can hardly be overrated. Regarding the atmosphere as the proved storehouse of that element, shown to be the special food of cereal crops, and repeated fresh exposure of the soil as the surest invitation to its absorption, this subject has become the meeting point in our day of the chemistry and the mechanics of agriculture, reflecting new immortality upon the labours and guiding instincts of Jethro Tull, carried out as they have been to more accurate demonstration by the unvarying personal success of his modern illustrator and improver, whose "word" is every year "in season," with four quarters and a half per acre, on the garden-farm of Lois Weedon, which still produces its annual crop, of wheat without manure, and followers with partial success.

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* The term will, of course, be understood only in its popular, *agricultural*, sense. In strict chemical language a manure can only be regarded as an exciting agent; a cause enabling by its presence the result of certain combinations.

But to return to the mechanical question. I shrink from speaking of myself; but let me not be thought to have slackened upon the great subject of steam culture. I have watched the spread and progress of the question from the time when its very name produced a smile, and have lived to realise a certain prophecy, that the time would quickly come, when the reclaim of the thought would be the harder task amidst the throng of speculators on the subject, each enveloped in the believed originality and perfectibility of his own idea. But it is a task which far exceeds, for its accomplishment, the power of a single hand. If all who nurse ideas upon the subject would but agree to sacrifise a little of that self-reliant individuality with which nature has gifted inventive minds, and those who pronounce upon the merit of whole catalogues of others' patents would but sink a little of that generality of which she has been equally liberal to minds that are not inventive, this invaluable object would be on the right road to its accomplishment, and England might add that *one-fourth* to its wheat crop which it now purchases abroad. The October temper of a clay soil will not wait while horses are eating and sleeping fourteen hours out of twenty-four; and the substitution of a power that needs no rest, at that period when the soil says, "Now or never," is not so much a question of economy in money as in *time*. I cannot desert the principle that that particular *mode* of turning the soil peculiar to the plough, is the mere relative necessity of a particular tool, that it may be done and is done in other ways, and that it will be done with less expenditure and waste of power, in detail, beginning from the top, as the planing-machine would eat through a board, than by upheaving the furrow-slice from the bottom, upon the hardened fulcrum of a subsoil already too compact and impervious; and lastly, that by so performing it in detail, the object of *cultivation*, supplementary to that of inversion with the plough, is incidentally comprehended in one operation: a confirmation, to my mind, on the principle of the occult relations of mechanical truth, that the suggestion is a right one. But an union of thought and action, and of all the sinews of enterprise, is the course that indicates itself for the accomplishment of this now widely-cherished object. Could the inauguration of such an union be ever more appropriate than in a place and in a presence, which recall to mind the greatest union for the sacred international brotherhood of industry and art, that time has yet witnessed?

I turn with natural interest to such a machine as Fowler's Draining Plough, with its happy incidental adoption of the lately-invented wire rope, and that most suggestive and satisfactory feature which it embodies in its stationary engine. It is impossible to see this, or, indeed, to read its inventor's practical remarks on steam culture, lately delivered here, without recognising in it the outline of something which may relieve our clay soils as much from the pressure of heavy hoofs and wheels on the surface in the act of cultivation, as his iron-strung necklace of pipes relieves their moisture from below, cutting through the subsoil like a cheese. It is upon the Steam-engine in every form, as it gradually wins its way from the fold into the field, and from the one engine that smoked in our trial-yard at Bristol in 1842, to the *fifty-seven* that stood in row at Lincoln, waiting to prove their speed and power by Mr. Amos's perfected Dynamometer, —it is upon this power that we must rest our hopes, for that mechanical progress of agriculture which our climate and our clay demands, and our mines of coal and iron, with equal speciality, present the means of.

There is one striking feature which has marked the period we are looking back upon, and has perhaps attracted the notice and interest of the non-agricultural world more than any other, and will hereafter become perhaps a distinguishing landmark of the time: I mean those numerous Example Farms, which, spreading gradually from one or two isolated instances, and weathering a somewhat rude storm during the range of low prices reaching from 1847 to 1852, are now sufficiently numerous to be said to afford a specimen almost in every county of what can be accomplished by a resolute enthusiasm in the adoption and carrying out of all the improved resources which capital and general intelligence can bring to bear. I use the term general intelligence, as distinguished from practical farming knowledge, not as at all denying the latter qualification, often in a very high degree accompanying the effort, and always gradually attainable, but because I shall not, I think, misdescribe the object and idea of these really patriotic establishments, in speaking of them as the pioneers who, generally speaking, have explored untrodden paths, and whose more prominent labours and results have been perhaps too much mistaken by the public eye for a general movement of the main line and body of our agriculture, to which they form a sort of advanced company. If, however, foreigners express themselves in terms of admiring astonishment at these examples of applied capital and skill, which they are taken, from one to the other, to visit, and from which, as in the case of that careful investigator and flattering eulogist of British agriculture, M. Lavergne, they naturally gather so high an estimate of our general progress, I think they would be not less astonished could they be made aware how large the bulk of farming is in this country which is literally unreached by the very echo of what is being done even within a few miles of its boundary fence. The terrible *per contra* that might be shown, if a balance were struck of the *acreable proportion of best farming* against the worst, is a subject that would be surprising to those who judge of the whole contents of the basket by the plump rosy apples that lie prominently at the top. The fact is that the revolution which has been taking place in the agriculture of this country presents, like the planetary motion from which the term is borrowed, a *centrifugal* as well as *centripetal* action; as the heavier capitalled portion, which has come to regard the soil as a mere arena for investment, has approached nearer to the utmost limit of profitable produce, a large outer circle of those who vainly persist in looking upon a farm as its own capital, are clinging on to holdings far beyond their means, and to a system which every invention and every improvement and every addition of capital to agriculture renders more untenable. The condition of the hand-loom weavers after the introduction of the power-loom, more obvious and sudden in its operation and the struggle it presented, was not more hopeless in principle. I fear no honest portrait of the condition of English agriculture could be given which did not include this shadow upon the back-ground. It is the result of an inflexible law, which no philanthropic regret can avail to alter. It is true that capital cannot be applied profitably to agriculture beyond a certain limit, as Mr. Lawes has shown by a simple table that submits it to the eye as plainly as an equation, so far as the growth of cereals is concerned; but the proof lies at a point so high, so far above the ordinary scale of farming, that for the present question it is as though that limit did not exist. Every description of improvement that we hear of with so much welcome, can only be of use so far as it tends to lower the cost of production. With every step in that direction the profits of the unimproved farm, of the uncapitalled occupier, are threatened to be left high-and-dry by the sinking level around. No advance of population will come to the aid of this. Occasional high prices, like the present, mask for a while the operation of this law, but in the long run it will be found that the market will not wait for, will not rise to meet the exigencies of a high cost of production. The "Mountain will not come to Mahomet." The remains of *the profit* still left to us, lie poised between two elements, and *the miracle* consists in escaping a collapse—viz., between the over-cost of cultivation and the under-level of the market price.

Nor does this apply to the occupier alone. Our system of landed settlements, like the cropping covenants in farming leases, are the creation of a period when the mere tenanting of a farm was a boon, a sort of grant, by which an old servant or dependant might be pensioned off, when, to use the shortest phrase, the land was its own capital. It now approaches much more to the character of a mill, in which, if the best machinery be not put in, the balance of profit is lost in useless labour and wasteful expense. Reaching the occupier first, it is yet upon the Owners of settled property that the impact of this movement ultimately falls. Improvement is not a choice—it is an imperative necessity. We have tried to reach the case by Government grants for drainage; but drainage is a mere first step, implying a succession and round of investment in the soil, in stock, in buildings, in barn-works, in additional hands, even to *furnish* the farm with its complement of requisite machinery. The annual loss which this country, with all its prominent and boasted agricultural improvement undergoes, by the tied-up hand of ownership, which settled estates, without proper powers for improvement both to owners and trustees, and land held under ecclesiastical leases, with the injurious system of septennial fines on renewal,* too extensively exhibit, is a subject that sooner or later must find a tongue, and a more efficient and constitutional remedy than government grants, which struggle with the effect, but leave untouched the causes which they incidentally recognise.

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* "AGRICULTURAL IMPROVEMENTS.

"TO THE EDITOR OF THE TIMES.

"SIR,—The comparative state of waste in which many large estates are kept by the want of improvement, is a loss to the country of considerable magnitude, and much good may be done by your exposing such an instance as I am about to relate, and which the experience of many of your readers, who have to deal with church or college estates, will say is not singular.

"The Dean and Chapter of ——— are owners of extensive farms, let to tenants on leases for 21 years, which it has been the custom to renew every seven years at a low rent, on payment of a proportionate fine. The general bad condition of properties so held is notorious. These gentlemen not only set their faces against parish improvements to which they may be asked to contribute—and upon this much may be said—but it will appear they are such enemies to innovation, that they not only refuse to assist their tenants in improving their farms, but will not even give them the opportunity of doing so at their own cost. I am the lessee of a large farm of theirs in Oxfordshire, which might be made very productive, but which is now almost a waste, and I am debarred from improving it by its want of draining; I, therefore, lately applied to the steward to aid me in obtaining a Government loan to drain it, expressing my willingness to pay the whole of the rent-charge during my occupancy of 21

An almost exhausted hour—I fear a quite exhausted patience—warn me to a brief conclusion, while the hydra-headed subject I have merely approached stares me in the face with its numerous and various topics, rising thicker and thicker to my view still untouched upon. Looking back over the space of my own, however limited, experience, and purposing a sketch, I have encountered *a history*, which no effort at compression could reduce into the narrower space I would gladly prefer. One subject alone I cannot end without a parting word upon, and that shall be as short as those words can be which carry long thoughts. When the cares and difficulties of an intractable soil first drew me from other studies to that of agriculture, what was my dismay to find that *books* were looked upon as the very rocks and shoals ahead to be *avoided*, not consulted, by the home mariner, the plougher of the land, who would escape shipwreck. Strange paradox! Yet of all the prejudices to be surmounted this seemed surely the most difficult, which would cut off every chart of information beyond that which the solitary steerer already possessed, or saw around him, in however wild a latitude. It is still, indeed, true, as so discriminately pointed out by one whose toiling and valued pen has ceased among us—Philip Pusey—that books will not teach practical farming; but neither, as he justly rejoined, are they a substitute for the apprenticeship of daily practice in any other pursuit. Yet, luckily—as no man better than the farmer knows—'knowledge is no burthen,' and the boy who whistles at the plough, or the man who holds it, much more the master who directs it, walks none the heavier, observes none the less acutely, draws truth from nature none the less easily, is none the less "in league with the very stones of the field," though all "Morton's Cyclopædia," and Stephens' "Book of the Farm," were sublimated into his brain. It would be toiling over a stale furrow to argue the point again, but it is impossible for me to look back over the period I have spoken of, without a keen sense of gratitude to the bold and brilliant pens that have broken through a barrier threatening to immure husbandry within the solitude which is in truth, its own greatest deprival, and in some degree inseparable from its steady and industrious pursuit, apart from the civilising thought and intercourse which the 'city mouse' enjoys. But who is there whose labour is not cheered and lightened by the words of those who, too far away for personal intercourse, are yet struggling with the same task as himself? Whether the scene lie among the now too classic fields of Pusey, in Berkshire, or amidst the liqui-fertilised and startled acres that once bore the dry and barren name of Tiptree-heath, in Essex; whether we imbibe long draughts of chemistry from the fountain-head at Rothamsted, in Hertfordshire, or seek a *too short* oblivion, or enjoyment, of 'Present Prices' upon the chalky downs of Dorset; or whether, deserting these hospitable homesteads, invited by the active spirit of the times, we start forth upon a general commission, with the "chiel amang ye taking notes, from the Solent up to John o' Groat's;"—do we find that such fireside companions as these diminish our practicality, or invade our winter evenings

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years. It may be necessary to explain that the Government advances money for draining, to be repaid by an annual rent-charge of 6½ per cent. for 22 years; but to obtain this a leaseholder for 21 years must get the lessor to join in their application. One would think that, as I am the lessee at a nominal rent for 21 years, and the money is to be expended in the permanent improvement of the land to at least the extent of the rent-charge, the lessors would be most happy to join in an application by which they would get their land permanently benefitted, at the expense of the tenant, to at least the extent of the outlay, namely, about £5 per acre;—I say to at least the extent of the outlay, because it is only on condition that the draining shall benefit the land to this extent that the Government advance is to be obtained; and, in addition to the benefit from the draining, the land would further have the advantage of the other improvements which the draining would lead to, but which its present wet state is a bar to. But no! the steward sees the possibility of the dean and chapter having to pay the rent-charge for one year at the end of 21 years, and does not see that by that time the estate will have been benefitted by my having made 21 payments out of 22, and that I am desirous of incurring the rent-charge for 21 years, from seeing that the farm must each year be benefitted more than the additional rent I undertake to pay, and at the end of my lease the lessors would come into the improved rent my outlay would have created at the cost of one year's payment; and so, by this refusal, I must continue to hold the land in its present unimproved condition for 21 years, and the dean and canon will, at the end of my lease, find their farm remaining in its present comparatively valueless condition, and thus their future representatives are being deprived of the improved rent which their joining in the application would secure them. But, perhaps, it may be said, seeing the advantage is so great, why do I not lay out the money myself? To this there is this unfortunate objection:—Were I to do so, when the time comes, seven years hence, to renew my lease, the same steward would be the first to assess the farm at the improved rent my outlay would have created, and thus I should increase the fine I should have to pay by my own act, and this, I think, every one in my position would decline doing.

"You are, doubtless, aware that the consumption of corn by this country has now attained to such an amount, that we require the assistance of about 11,000,000 quarters per annum of foreign growth; and, this being the case, is the production of the large estates vested in trustees for the public advantage to be kept down in this way by their worse than ignorance of their duty to their tenants, to their successors, and to the nation? I think you will see in this a subject of general importance, and I trust I need not further apologise for troubling you and asking you to insert this in *The Times*.

"I remain, sir, your obedient servant,

"T. R. B. C.

"Northamptonshire, Jan. 11, 1856."

less usefully and pleasantly than the *Gazette*, or *Express*, or *Messenger*, or other weekly page which brings us tidings of the markets of the world, to which not more the trade than the mind of British Agriculture has been opened? I, at least, for one, must acknowledge that in the steady and progressive change which "Practice with Science" has wrought upon the aspects of English farming during the fifteen years past, the most striking, the most complete of all has been, where I saw most to despair of in the outset,—in its LITERATURE, both practical and scientific (for even in its literature these two classes must co-exist). Did I need a token—a convincing attestation—that in the threefold character of farming, as an 'Art,' a 'Manufacture,' and a 'Commerce,' and, let me add, an *Education*, its interests and progress are *felt* as among the highest objects of the highest minds,—in the spirit, if not the words, of a well-known epigraph, "*Lector, si* indicium *requiris, circumspice*,"—I might gratefully recognise it here, before my brother-members and the Council of this Society, and the Presiding presence of one who, amidst the absorbing avocations of a life devoted to the promotion of the useful, the beautiful, and the good, has practically earned, and freshly dignified, a name associated of old with the Throne and Royalty of England—the name of a British Farmer.

DISCUSSION.

MR. J M. PAINE, of Farnham, said—Having been honoured by the invitation of the Council to speak a few words on the Geological resources of Agriculture, I will not occupy the time of your Royal Highness and of the meeting by any further prefatory remark. I fear that it must be admitted that geology has not hitherto done much for agriculture, and although its resources are manifold, that it has not done what it ought and might do. Still some good things have been effected by its means, and more particularly within the fifteen years of the interesting review so ably presented to us by Mr. Hoskyns. But geology without the aid of chemistry as an interpreter will not profit the farmer. Chemistry must tell us what to find, or when we have found it what it is, while geology teaches us where to search for it. It has been said, however, in disparagement of such combined investigations, that the knowledge of the constituents of the true geological subsoils is of little value, inasmuch as the greater part of our cultivated fields is composed of superficial drifts, oftentimes differing widely in character from the soils they overlie. That this is usually the case is most true; and still more these drifts are generally of so mixed a character, that it is not likely we should obtain much advantage from a chemical knowledge of their ingredients, as such information would not admit of general application. Geology, however, would here serve agriculture in another manner, by teaching the extent, depth, and direction of these diluvial drifts; and this knowledge is often very useful in the drainage of land. I need scarcely remind my present hearers how this has been signally and successfully exemplified in the case of Lord Berners, at Keythorpe. On a much humbler scale I have derived similar benefit in draining some of my own land at Farnham. But I consider that agriculture would ultimately reap many advantages, did it possess an analytical knowledge of the true geological subsoils as they outcrop in various parts. From my own experience, I can confidently state, that the soil of one field is frequently the most appropriate manure for another. And it sometimes happens that examinations of this nature lead to the discovery of beds of peculiar substances, which act as specific manures, and will bear the expense of distant carriage. Such discoveries have been made, and, I think, there are sufficient grounds for indulging in the sanguine hope that a more diligent research would be rewarded both by pecuniary and scientific success. In confirmation of this opinion, I need only remind you of the several sources of phosphates which geology has already developed, and many of which agriculture has wisely appropriated to its use. It is sufficient merely to name the mineral phosphate of lime which Dr. Daubeny introduced to our notice from Estramadura—a name about as happily chosen as the "coppery lights" applied to my friend Mr. Huxtable; the so-called coprolites from Suffolk; the phosphatic nodules from Cambridgeshire; the fossils and nodules of the upper and lower green sand from Farnham, and the base of the chalk-hills generally; the mineral phosphate from New Jersey; and, lastly, and perhaps the most important, a very pure *apatite* recently imported from Norway by Mr. Lawes, from which super-phosphate of a most superior quality is now manufactured, containing from 30 to 40 per cent of the soluble phosphate of lime. These discoveries are due to geology, and I think they ought to stimulate us to undertake more complete investigations; and I confess that I should heartily rejoice to see set on foot a carefully-conducted chemico-geological examination of all the subsoils of this kingdom. I have endeavoured to commence this task, so far as relates to one well-known geological division—I mean the chalk; and having obtained the eminent chemical assistance of Professor Way, I have hitherto been well rewarded for my pains. The Royal Agricultural Society, I am persuaded, would willingly assist gentlemen in kindred investigations, and if this recommendation were systematically carried out, I believe very valuable results would ensue. Might we not hope to discover in our granitic districts rich veins of phosphate of lime like those I have just mentioned? For phosphoric acid is of frequent occurrence in these rocks; it is, I imagine, one of the primeval existencies of our globe, as it in fact constitutes a large proportion of that "dust of the earth" out of which man and all other animals were created. Geology, too, with the help of chemistry, has shown us on what lands to grow specific crops. It is well known that the peculiar botany of any district is chiefly determined by its geology. So also does it indicate the description of agricultural crop to be cultivated with profit and advantage. I may perhaps be permitted to illustrate this remark by reference to the growth of the hop, a perennial plant requiring the richest soil. Until I brought geology and chemistry to bear on some of my own fields, they did not pay me 5s. per acre rent. I compared their soils, both geologically and chemically, with hop grounds worth £20 per acre, and I found them alike in geological position and chemical analysis. There now remained only one obstacle to their being placed in a very different category of value—that impediment was water;—the land was deeply drained, and the fields became worth £10 per acre. My attention, as I stated just now, has been more specifically directed to the chalk formation, as my land affords peculiar facilities for its examination. In a section of about two miles, running from S.E. to N.W., I obtain every outcrop, from the low green sand to the plastic clay. These have been examined, as it were, step by step, and we found beds of phosphate of lime, clay with a large per centage of potash, thick beds of the soluble or gelatinous silica, and carbonate of lime in every variety. Some of these carbonates of lime strata furnish an excellent marl, as they are intimately commingled with alumina, potash, silica, and phosphoric acid. This marl is applied to other parts of the farm whenever opportunities offer for its transit. It is a marl of this description in the lower chalk which has been so abundantly used from time immemorial throughout the south of England, and probably to a greater extent formerly than at the present time, if we may judge from the immense old marl pits of this district. Here, as in many similar instances, practice derived from experience first indicated a rich and peculiar soil, the real value of which was not known until science told us what were its ingredients and their fitting application. The soluble silica beds of the chalk form a very remarkable soil. On my farm at Farnham, they are about 100 feet thick, and from the lower to the upper member of the series, the per centage of the soluble silica ranges from 20 to 76. This substance has not received much attention hitherto, either from agriculturists or chemists; indeed, prior to this discovery, soluble silica was far too costly an article to be employed for agricultural purposes. If it be useful, it can now be procured at a very trifling expense. I use large quantities of it on my farm, and immense quantities are used in the neighbourhood. The soft parts are spread like mud over the fields, or employed as a covering to, and as a bottom to dung-heaps, and also to spread over the bottom of the fold-yards and farm-yards. The hard parts are dried, and ground up into a fine powder. This is used to absorb the urine in the tanks, and to litter up the fattening pigs, as a substitute for straw. It thus forms an excellent drill-manure for root crops. As an absorbent and deodoriser it is equal to charcoal dust, and I need scarcely add, that it is much cheaper. Possibly, the best way of using this substance is to convert it into silicate of lime, which is very easily effected. The methods are fully described by Mr. Way in Vol. XIV. of the *Journal of the Royal Agricultural Society*. At Binsted and Selborne, in Hampshire, lime is largely employed on the out-croppings of these silica soils. The farmers there speak highly in praise of its application, while on the gault soils below, they say that lime does very little good. I formerly laughed at them for what I considered their misapplication of lime; but the farmers were right,—for the gault there contains much carbonate and sulphate of lime, while the silica rock, which resembles a piece of impure chalk, contains scarcely a trace of lime. Here, again, practice was in advance of agricultural science. I will not detain your Royal Highness and the meeting by any further remarks, observing only in conclusion, that the earth furnishes supplies of organic as well as inorganic manures, and that our coal-fields might furnish us with an abundance of ammonia, now wasted in the ordinary consumption of coals, and that many of our soils contain latent stores of this valuable article; and if chemists would set their brains to work, and teach us how to avail ourselves of these riches, it would indeed prove a great boon, not only to farmers, but to the community at large.

Mr. J. B. Lawes, F.R.S., said—The period which Mr. Hoskyns has selected as the starting point, in his most interesting and instructive paper just read to us, although comprising so small a portion of time, in the history of British agriculture, refers back to a period sufficiently remote to include the whole history of the chemistry of agriculture, so far as it relates to this country. Whatever might have been known or practised in other countries before that period, certainly neither attracted the attention nor influenced the practice of the agriculturists of Great Britain. It is to an illustrious countryman of His Royal Highness, to Baron Liebig alone, that is due the merit of having effectively roused the attention of British farmers to the importance of applying chemical science to advance the practice of their art. Although fifteen years have elapsed since the first work of Baron Liebig was published, the foundation of this new science can hardly yet be said to be laid, or the first truths admitted without dispute. When we consider the wide distinction which exists between the man of science and the practical farmer, and the very different points of view from which they would regard the use of this new science, it could hardly be expected but that serious disagreements should arise between them. The question of profit and loss naturally enters largely into all the views and considerations of the practical farmer, while the scientific man entirely disregards it. To obtain the same increase in vegetation by the employment of a few pounds of white crystallised salts as would be produced by a cart-load of dung, is to the man of science a phenomenon of great interest, irrespective of any question of cost, but to recommend this salt to be used for agricultural purposes, would depend upon economical questions, having no connection with science. For want of practical knowledge the man of science, although correct in his principles, has often erred in the application of these principles to practice. For want of scientific knowledge the agriculturist has expected from the teachers of science rules to guide and improve his practice, which the science of the day was quite incapable of supplying. Hence the farmer is inclined to regard the man of science as visionary, theoretical, and unpractical, while the man of science accuses the farmer of indifference to science, or applying to it only to furnish him with recipes to enable him to fill his pockets more rapidly. It has of late years been too much the custom to explain everything connected with the practice of agriculture by means of chemistry alone. I would, however, venture to claim for agriculture the rank of an independent science, in close alliance, it is true, with chemistry, botany, physiology, and some other sciences, but still distinct from them all. Its truths can alone be investigated and explained by experiments conducted in the field with all the aids and refinements which modern science affords. It is a science abounding in difficulties, and yielding its fruits but sparingly to those who cultivate it with the greatest assiduity. Although it would not be easy, or even possible, to point out distinctly in what way science has advanced the practice of agriculture from year to year, there is evidence of a very marked progress, if we compare two periods sufficiently remote. When we consider that, ten years ago, it was thought that every description of soil would require special manures to suit them, it is no small addition to our stock of knowledge to have ascertained with certainty that when once we know the most suitable manure for any particular crop, it will be applicable for all soils. The farmer who leaves the light soil of Norfolk to cultivate the heavy clay of Warwickshire, requires no analysis of his soil to tell him that the same artificial manure which he used successfully to grow his wheat on one soil will be equally applicable to the other. I would go further, and say that the same rule would hold good in any part of the world where wheat is cultivated. Ten years ago, nothing certain was known of the value of manures in connection with their chemical composition; at the present time, there are many in this room who would be willing to accept the chemical composition of any manure as the measure of its value. If time permitted, I could point out to you that more correct views are also entertained on the subject of feeding animals; that we begin to know that a rotation of crops is not a necessity, but merely an economical process for obtaining certain ingredients essential to our corn crops. With increased knowledge, the necessity for any fixed routine will be no longer apparent, and the farmer will be free to pursue that system which freedom of competition and fluctuation in price render necessary to enable him to realise the full reward for his skill and capital.

MR. ALLEN RANSOME said—I have listened with great pleasure to the interesting paper read by Mr. Hoskyns; and in venturing to make a few remarks on that portion of it which is more immediately connected with my vocation as an implement maker, I am desirous to lay before the meeting such facts as will enable it to form a just estimate of the comparative state of agricultural mechanics during the period referred to by Mr. Hoskyns. I do not entirely agree with Mr. Hoskyns as to the amount of improvement which has taken place, within the limited time he has assumed, as coincident with the establishment of the Royal Agricultural Society, nor am I prepared to go the full length of attributing the present state of agricultural mechanics so exclusively to the influence of that body. It is very far from my desire to depreciate the workings of that Society, or in the slightest degree to detract from the vast amount of good it has conferred on the cause of agriculture generally, and to that portion which involves its mechanics in particular, but I should hardly do justice to those who for many years before the establishment of that Society were contributors to the advancement of agriculture through the medium of its mechanics, if I did not avail myself of this opportunity to vindicate the position which they had attained long antecedent to the establishment of the Royal Agricultural Society. The first meeting of that Society at Oxford could hardly be supposed to afford very fair evidence of the state of agricultural mechanics at that period; the Society was little known—its rules less so, its motives doubted, and many held back from contributing to its exhibitions, in order that they might see what others would do, and how they were likely to fare. The meeting was limited certainly, but, limited as it was, at this meeting and the one succeeding, one or more good specimens of all the best implements then in general use were exhibited, and if I might be allowed to lay before you the names and character of the instruments then in use and there exhibited, you will be enabled to judge to what state agricultural mechanics had at that date arrived. There were drills by Garrett, Hornsby, and Smith; ploughs by Ransome, Howard, and Barrett; zig-zag harrows by Howard; portable thrashing machines by Ransome, Garrett, Barrett and Exall, and Hart; winnowing machines by Cooch and Hornsby; clod crushers by Crosskill; turnip cutters by Gardner; haymaking machines by Wedlake; chaff engines of great variety by Cornes, Ransome, Garrett, Richmond and Co., and many others; and rollers of every description. It is no less a fact, that all these implements remain at the present day standard implements, little if at all altered in their principles, though perhaps generally improved in their details. In the subsequent period many new inventions have from time to time made their appearance at the Society's exhibitions, many crudities, and many novelties. Most of these had have their short hour of fame and trial, and eventually have disappeared for ever. Amongst those introduced during the last 15 years, which have since proved their title to be added to the original list of standard implements, the following stand as the most prominent:—Garrett's lever horse-hoes; Grant's, Smith's, and Howard's lever horse-rakes; Bentall's broad share plough; Bushe's, Baxter's, and Phillips's root pulpers; Biddell's bean cutter, and many improvements and varieties of chaff-cutters and of mills. These, with those mentioned as existing previously to the Oxford meeting, may be considered as mainly comprising the class of standard implements of the present day. I have not included in this list the reaping machine, upon which much ingenuity and cost has been expended to adapt it to the requirements of this country, by several makers, because it has not, as yet, assumed the character of a standard implement; but, I think, another season will not pass without at least one specimen which may secure for it that position. Having now, I trust with all becoming modesty, shown the position to which agricultural mechanics had attained—both prior to 1839 and since—I will endeavour to explain the causes to which the present general use of the standard implements is mainly attributable. 1st.—The improvements in all machinery and tools for working in wood and iron, producing a superior style of workmanship at ordinary cost. 2nd.—To the facility of transit afforded by railways. 3rd.—To the necessity of economising all farming costs by means of every labour-saving machine; and last, not least, to the opportunities afforded by the itinerant annual exhibitions of the Royal Agricultural Society, for general observation, test, and comparison of all the best implements throughout the length and breadth of the land. This has enabled the makers of implements in every district to profit by the examples of the best implements of all other districts, and the standard being selected as of the highest class, the best implements have become more generally diffused; the advantage obtained to the agricultural community, arising less from the introduction of new inventions, than from the general adoption throughout the country of the best implements of every district, with a general improvement in the style and quality of workmanship. Hitherto, I have only spoken of the instruments as ordinarily used by horse or hand power; but the introduction of steam-power in its portable form has opened up a wide field for the ingenuity and enterprise of the manufacturer; inasmuch as, by its aid, machines of a much more comprehensive character, which are beyond the limits of ordinary horse-power, can be constructed; and in this direction the energy and the ability of the agricultural machine manufacturer has been largely called into action, and with most satisfactory results, especially in relation to the steam-engine itself, and to the thrashing machine, which combines, with the merely thrashing operation of beating out the corn, the further stages of separation from offal and the production of a perfect sample, fit for market. Important, however, as has been the application of steam power, whether to fixed or portable machinery, greatly more important would it be if it could be brought to bear upon the tillage of the soil. All honour to the inventor of the steam tile-draining machine, who by his persevering exertions has at last effected the first stage of this desirable object; but a very much wider field remains yet to be accomplished in the tillage of land by steam; and honour to all those who have attempted the further stages. The mode in which it is to be accomplished is at present only seen in the distance. There are many and various views as to the best means of effecting it, but certain it is that the experiment is too great for any one individual—too large for individual enterprise. The cost of inventions, of experiments, of trials, and of errors, is enough to drain the deepest purse, and break the strongest heart. I have no hesitation in saying, that if the object is to be accomplished within a reasonable time, as it is a matter that would result in great national good, it should be made a matter of national cost. The funds, I believe, are all that is wanting to bring about some arrangement which will have a practical effect. Until some such general fund is obtained, we shall go on hoping, each hope to end in disappointment. This is not the time nor the place to enter upon the plan, but I should be most happy to confer with any one on the subject, and throw my information into the general fund for the accomplishment of such a desirable end.

Mr. JOHN HUDSON, of Castle Acre, spoke as follows:—I have been requested to speak a few words upon the subject of the progress of Practical Farming during the last fifteen years. The scientific gentlemen who have preceded me this evening have entered so fully into the subject, that they have left me an almost barren field to work upon. I must, therefore, crave your Royal Highness's indulgence to be allowed to allude to the early part of the present century, when Thomas William Coke, the late Earl of Leicester, adopted and recommended the improved system of practical agriculture. At that time the county of Norfolk consisted of large tracts of wild heaths and rabbit warrens. Rye was extensively grown, but very little wheat was produced there. Mr. Coke recommended the farmers to cultivate the turnip crop upon an extended scale, and it was at that time the drill superseded the broad cast method of sowing both corn and turnips. Mr. Coke spent large sums of money in building convenient farm premises for his tenants, and encouraged them to improve their farms by granting them 21 years leases, with liberal covenants. And it was his pleasure, at the latter part of his life, to give his improving tenants the best tenant right they could have—a renewal of their leases four years before the expiration of the term, and that without taking undue advantage of the outlay of the tenants' capital. Up to 1821, he held annual meetings at Holkham, in the month of July, where he gathered around him all the scientific skill and practical experience he could obtain at that time. I have there seen Sir H. Davy, Sir Jos. Banks, Dr. Rigby, and the only agricultural chemist of the day, Mr. Grissenthwaite. They thought there was something "looming in the future," but it remained to the period named on the paper for discussion this evening, for the further development which chemical science has brought to bear upon agriculture. It is to Liebig, Lawes, Paine, Way, and others, that we are indebted for the discovery of the method of converting the hard bone into food for the infant plant of our root crop. In my early days, the turnip crop was a most uncertain one to obtain; but now that our chemists have made these important discoveries, it is almost reduced to a certainty. It was about fifteen years ago that the Royal Agricultural Society of England was formed, under the auspices of his Grace the Duke of Richmond and the late Earl Spencer, Mr. Pusey, and Mr. Handley. That Society has offered prizes for improved implements, as well as improved breeds of cattle, sheep, horses, &c., and held out inducements for chemical science to aid practical farming. When I first put my hand to the plough, it was a very primitive implement, and performed its work imperfectly. Ransome and Howard have improved our ploughs; Garrett has improved Cook's drill and the inverted horse-hoe, which was invented by Francis Blaikie in 1816, and which I first used on my farm at Castle-Acre in 1823. These improved implements have very much tended to the progress of practical farming during the last fifteen years. Ransome, Clayton and Shuttleworth, Hornsby, Tuxford, and others, have brought out the steam thrashing machines. These have greatly lessened the cost of production. The legislature of this country has also done much towards the progress of agriculture. Some twenty years since, the alteration of the tithe-law took place, and labour was set free by the repeal of the old poor-law, without which improved practical farming could not have progressed as it has done. The people require cheap food. This can only be obtained by lessening the cost of its production. The three great items in the farmer's expenditure are rent, labour, and the purchase of artificial manures. As the area of these islands cannot be extended, we must not expect the first to be much decreased, and the labourer is not too well paid. It appears to me that the best way to reduce the cost of agricultural production is to endeavour to obtain the manures at less cost. We are told that many of the uninhabited islands in the Pacific abound in fertilizing matter; and could it be supplied at about half the present price, it might enable the farmers of England to raise an abundant supply of food, both bread, corn, and meat, for the increasing population. I trust the farmers of England will not be considered drones in the busy hive of industry, as, in my opinion, they have endeavoured to keep pace with the advancement of the manufacturing and commercial community of these realms.

H.R.H. THE PRESIDENT said, I feel that I am only carrying out your wishes in proposing to you that we should return our best thanks to Mr. Hoskyns for the very valuable paper which he has read to us. He has given us a very accurate and succinct history of the progress of agriculture, in that peculiarly agreeable and epigrammatic style which is familiar to every one who has read his amusing and valuable little work the "Chronicles of a Clay Farm." He has not only interested and amused us for the hour, but he has given us much to think on; and if he has taught any one lesson of greater importance than another, it is that the future progress of agriculture will mainly depend upon the close and intimate union and the hearty co-operation of science, art, manufactures, and commerce, and that the primary condition of a successful progress for the future will be the obtaining of accurate and complete agricultural statistics. And here I hope I am not trespassing in asking you gentlemen, and every one of you, in his particular circle, to contribute his mite in obtaining those statistics which are so much wanted, and which Government is now trying to collect. I merely repeat our thanks to Mr. Hoskyns for his interesting paper.

Mr. HOSKYNS having briefly replied,

The SECRETARY announced that the paper to be read at the next meeting was "Recent Progress in Design as applied to Manufactures," by Mr. George Wallis, Head-Master of the Birmingham School of Design. On this evening, Mr. Henry Cole, C.B., Vice-President, will preside.

EXAMINATION OF MEMBERS OF CLASSES AT ASSOCIATED INSTITUTIONS.

Mr. John Wood, Chairman of the Board of Inland Revenue, has placed two appointments annually, in the Surveying Department of the Excise, at the disposal of the Council of the Society of Arts. They are to be competed for at the examination which will be held at the Society's house, in the Adelphi, next June.

It may be convenient to those interested in the above announcement to know what qualifications are required for the surveying branch of the Inland Revenue. The following are the Rules laid down by the Commissioners:—

The candidate must, on entering the service, be not less than 19, nor more than 25, years of age. A baptismal certificate, or other satisfactory evidence, will be required.

He must be healthy and active, and without any bodily infirmity. Of this a medical certificate will be required.

He must not be encumbered with debts; and must be unmarried, and without family, and of respectable character; and he will not be allowed to marry until he attains the rank of ride officer.

He must understand arithmetic, so as to work out sums in the rules of addition, subtraction, multiplication, and division, both in common arithmetic and in vulgar and decimal fractions, reduction, proportion, practice, and interest. He must be able to write a good hand, and correctly and fluently from dictation; and have a competent knowledge of book-keeping by double entry.

He will undergo an examination in the above-named subjects, and if approved will be placed under the instruction of an Excise officer for at least six weeks; at the expiration of which period, if he be found qualified to perform the duty of an officer, he will be certified for accordingly, and his salary will commence.

Home Correspondence.

AN ACCOUNT OF THE INTRODUCTION AND THERAPEUTIC USES OF GLYCERINE.

SIR,—Since the *Journal of the Society of Arts* published the few observations made upon the employment of glycerine during the discussion on Mr. G. F. Wilson's interesting paper upon the products of Price's Patent Candle Company, I have received several communications, seeking further information on the subject, and complaining that the paper in the *Medical Times* journal, for the year 1850, referred to by Mr. G. F. Wilson and myself, was out of print. Will you, therefore, oblige me by reproducing this account of the introduction and therapeutic uses of glycerine, as it will not only answer these inquirers, but will also be found to have anticipated much, if not all, that has been said or written by others, either in this or other countries, upon the medical uses of the liquid under consideration.

To my friend, Mr. Thomas De la Rue, who was employing glycerine in the arts, I am indebted for first directing my attention to this useful agent, when a consideration of its properties and nature at once suggested its applicability for the purposes for which I have recommended it, and which subsequent experience has verified. Glycerine was at that time, 12 or 13 years ago, a waste product formed in making diachylon plaster; indeed, in its pure form, it was a sort of chemical curiosity, in so much that when my desire to obtain a quantity of it was mentioned to some of the chief chemists of London, at an assemblage of the Pharmaceutical Society, in 1845, a few pounds only could be procured; and had not Mr. Button, of Holborn, and Mr. Thomas Taylor, of Vere-street, undertaken its manufacture for me, this important addendum to our list of therapeutics would probably have remained in statu quo, and this part of the profits of Price's Patent Candle Company in abeyance.

The following is the first published notice of glycerine; it occurs in a lecture on *Pityriasis*, or dandriff of the skin, delivered by me at the Hospital for Skin Diseases, in 1845, and is printed in the *Medical Times* journal, vol. 13, 1846, and is afterwards repeated, with additional matter, in the 21st vol. of the same journal, for the year 1850, from which the subjoined extracts are made (page 27 *et seq.*):—

"Another very efficacious means remains to us in glycerine' which, as a palliative in squamous affections of the skin, has not, to my knowledge, been hitherto made known or adopted; in fact, it is peculiar to myself; and although I have not as yet addressed the profession or any learned body on the subject, in accordance with my intention, when my observations are matured, I will, nevertheless, here announce it for your consideration. It consists in the employment of this liquid I hand round, discovered by Scheele at the end of the last century, which has the property of remaining fluid, and resisting evaporation under any temperature to which the body can be exposed; indeed, I have wetted a common dinner plate with it, and kept it in an oven whilst a joint of meat was cooked by its side, and the liquid has experienced no evident change or diminution. The facility with which this body mingles with water or other fluids, even oils, renders it an invaluable adjunct to lotions, poultices, embrocations, and applications, the utility of which may consist, not only in diminishing temperature by evaporation, but in softening and relaxing the heated and inflamed skin. The tendency to dry up, and adhere to the part, as is well known, often frustrates the beneficial effects of these applications, and various counter-active expedients have consequently been adopted, as the addition of fatty matters, or covering the poultice, lotion, &c., with oiled silk. Now this is rendered entirely unnecessary by the addition of the liquid I have submitted for your inspection. You will perceive glycerine has the appearance of oil, and when rubbed upon the skin it furnishes a thin coating, or varnish, which even the *microscope* fails to distinguish as different from the ordinary secretions of the part. Half an ounce of this liquid, added to half a pint of lotion, will prevent the skin becoming dry. In baths the result is also equally apparent, but here the cost is an obstacle, though the liquid is by no means dear,[*] as, at the present time, tons of it are thrown away, but if, as I anticipate, its application prove general, its price will be shortly augmented. This fluid body, to which the chemists have given the name of glycerine, is a peculiar, uncrystallizable, unfermentable saccharine matter, found in animal fats or oils, and produced during their admixture and combination with alkalies, earths, or oxides. Thus it is most abundant in the refuse of the soap and stearine maker. That which you are now inspecting was procured from Apothecaries Hall, and is formed during the manufacture of lead plaster on a large scale. *I should mention, that it requires to be diluted with water for use, otherwise* it

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[*] The price then paid for tolerably pure glycerine was 1s. 6d. per pound.—J. S.

makes the skin feel stiff, uncomfortable, and sticky, but as I am now about concluding some experiments, long since commenced, on the application of this liquid as a therapeutic agent to several forms of cutaneous disease, I will defer any further observations on it till a future occasion. In the meantime, I shall be obliged if any professional brother will give it a trial in his practice, and communicate to me the result."

To redeem the pledge thus given, two years afterwards the pages of the same journal (*Med. Times*, vol. XVI., p. 469) contained a renewal of the subject, when, after describing the mode of preparing glycerine, and its chemical composition, I gave the subjoined summary of its therapeutic uses:—

"In the use of glycerine internally I have had little experience, but it is a mild stimulant, antiseptic, and demulcent, and might be employed to sweeten many articles of food or drinks for those invalids whose disordered digestive organs forbid the use of sugar. Pills made with the addition of a few drops of glycerine will not become dry, and syrups and extracts by its means are kept moist, as also free from fermentation, and the formation of cryptogamous vegetation, or mouldiness. Many other such like uses for this agent will not fail to suggest themselves, for the recapitulation of which, however, the pages of a medical journal can scarcely be deemed the appropriate place. I shall, therefore, briefly enumerate some of the diseases of the skin in which I have employed glycerine as a *local palliative* with most benefit and success. These are, Pityriasis, or dandriff, particularly that form of the disease which I have termed (P. congenita), Lepra, Psoriasis, Lichen (in its advanced stage), Eczema, Impetigo, and Prurigo. I have found glycerine also a useful addition to lotions in the encrusted forms of Lupus, or Herpes Exedens, and to various Syphilitic or Strumous eruptions, having a tendency to produce fetid discharges and hard crusts, for which reason, also, it has proved of service in the scabbing stage of small pox, to prevent scars and pitting. As a wash also for the hair, and for chapped hands, face, or nipples, combined with a little rose-water, and a few grains of borax to the ounce, the glycerine being in the proportion of one-eighth to one-sixteenth, this remedy furnishes, perhaps, *one of the most elegant and efficacious preparations which has been introduced*. If may also be combined with soaps, which it renders peculiarly softening and detergent, particularly for individuals who have a hard or dry skin."

"To this somewhat lengthy communication I will only add, for the guidance of those amongst your readers who may desire to make trial of this remedy, a few of the more common and useful formulæ employed at the Hospital for Diseases of the Skin, where glycerine is extensively used, notwithstanding its present high price (3s. to 5s. per lb.) proves a considerable obstacle, the funds of this Institution being quite inadequate to meet the increasing demands upon them. I would premise that glycerine should *rarely ever be used undiluted* for cutaneous maladies, and that when prescribed in the annexed recipes, *the pure inodorous and anhydrous quality* is alone indicated, which is of a pale sherry colour, and of the consistence of treacle, care being taken not to employ a spurious article lately found in the shops, composed chiefly of honey, or sugar, gum, and water."

Here follow some Latin prescriptions, in the *Medical Times* Journal, of which I translate a few for domestic use.

For superficial burns, scalds or excoriations, tetters of the lips, nose, &c., after colds.—Take of gum tragacanth half an ounce, pure glycerine one ounce, lime water two ounces, double rose water enough to form a soft jelly, to be used by way of ointment or embrocation.

For chapped hands or nipples, fissures of the lips, irritation of the skin of any kind, as after shaving or exposure to the sun, or for roughness, scurf, or dandriff, on any part of the skin.—Take of borax half a drachm, pure glycerine half an ounce, rose, elder, or orange flower water half a pint, to be used as a lotion, with soft sponge or linen, to dab the affected parts.

For baldness following fevers, or other severe illness, or for falling of the hair from dryness and want of action in the scalp.—Take of strong spirits of sal volatile one ounce, tincture of cantharides two drachms, rosemary water half a pint, and pure glycerine half an ounce, to be used with a sponge or wetted hair brush twice a day.

For rheumatism, gout, bruises, sprains, stiffness, &c.—Take equal parts of pure glycerine and camphorated oil, or opodildoc, or chloroform, and use as an embrocation to the affected parts.

Of course this list might be greatly augmented, but enough has been stated to show the mode of using a remedy which I cannot have employed less frequently than in 15,000 cases, amongst nearly 70,000 patients who have been treated by me, during the last fifteen years, for various forms of skin complaints at the hospital under my care; and I must say I have found it, when applied according to the foregoing principles, *one of the most useful applications* AS A PALLIATIVE *in these afflictive maladies*. I have also, as mentioned to the Society of Arts, applied glycerine efficaciously, alone or combined, for frost bites, chilblains, &c.; and also as a means for embalming, both for purposes of dissection, and for preserving objects of natural history; as also in the preparation of salt meats, as well as in extracts, confections, pills, distilled waters, &c., kept by apothecaries; in short, as a substitute for spirits of wine, vinegar, and syrups, the latter of which, in medical preparations, it might advantageously supersede, the cost permitting. The only marked advantage I have witnessed from the internal administration of glycerine has been in some forms of indigestion, and as a vehicle for taking cod liver and other oils; and patients suffering from that ordinarily fatal complaint Diabetes, have derived benefit and comfort from its use. It would be remiss to conclude this notice without expressing my obligations to Mr. Geo. F. Wilson, of Price's Patent Candle Company, for the scientific improvements he has effected in the manufacture of glycerine, which has rendered this remedy not only much more certain, because purer, but much cheaper for the general public, though it is hoped the cost may be still further reduced; whilst the liberality of his company, *in gratuitously furnishing an ample supply of pure glycerine to the afflicted poor attending the Skin Hospital*, deserves and receives the warmest acknowledgments of myself and the committee of management conducting that institution.

I am, Sir, your obedient servant,
JAMES STARTIN.

IRON FOR ORDNANCE.

SIR,—Perceiving no reply to Lady Bentham's query respecting the carronades on the experimental vessels of 1795, I beg to state there can be little doubt they were cast with mineral fuel. The Carron works were erected about the year 1767, by Dr. Roebuck, for the then newly established manufacture of pit coal pig iron, a revival of the patents of Dudley in 1619. Dr. Roebuck, the grandfather of the present M.P. for Sheffield, was a man of the largest capacity, liberality, and enterprise, and his life furnishes a strong incidental instance of what appears inevitable, that he who carries the pence also carries the praise. Dr. Roebuck was the first partner with James Watt, made large advances upon the then improved prodigy which was destined to revolutionise the world, and by his intelligent advice was of the greatest assistance in perfecting it. He subsequently released to Watt his share (two-thirds) of the patents on very liberal terms; and a share of the invention thus tested and completed by Dr. Roebuck's penetration and capital was subsequently purchased by Matthew Boulton. Boulton's name thus becoming linked with the commercial success of the invention, it is he alone who is spoken of by fame as the intelligent capitalist who appreciated and selected for investment the hidden and even despised offspring of Watt's genius; whereas it is to Dr. Roebuck that this first merit is actually due. Boulton was liberal and intelligent, and had the acuteness to make an excellent outlay, but he holds by right only the second place as the appreciator of Watt. I believe Dr. Roebuck's first attempts at Carron were not successful, in fact the range of his faculties carried him into too many enterprises at one time, but I very much doubt if any charcoal pig iron was ever made at those works, certainly not in the last decade of the century, for the Carron manufactures of pit coal iron had thoroughly established their character prior to 1780. Nothing can be more vague, more unsound, partial, and inconclusive, than the scattered notices which have been flying through the daily press, that the manufacture of cannon from charcoal or peat iron, must be resorted to here, to enable our artillery to compete with the Russian guns. Not one hundredth part of the evidence necessary to establish the real facts, or to come to any correct conclusion, have even been adverted to in these discussions and suggestions.

I am, Sir, your obedient servant,
DAVID MUSHET.

Feb. 17, 1856.

Proceedings of Institutions.

BOSTON.—The annual meeting of the members of the Athenæum was held on Friday, the 15th of February, Mr. T. Garfit, president of the society, in the chair. From the annual report of the committee, it appears that some time during the approaching summer, the new building now erecting in front of the Corn Exchange will be ready for the accommodation of the members. In the fitting up of this building the Committee expect considerable expense will be incurred, for which purpose donations are solicited from the more affluent members. The failure of a scheme for the formation of an union of the Literary Societies of Lincolnshire, as proposed by the Society of Arts, is regretted. The financial report is very satisfactory, there appearing to be a balance in the hands of the treasurer of £99 13s. 2d. (exclusive of £40 balance of Exhibition account). A small increase in the number of members is also noted, and a suggestion thrown out by which it is hoped the number may be considerably increased during the ensuing year. A classified list is given of the members; out of the total number (450) there appears to be only 11 mechanics, the class for whose benefit the society was originally established. There are 174 merchants and tradesmen, 78 clerks and assistants, 67 farmers and country members, 12 clergymen, 8 magistrates, 19 independent gentlemen, 30 bankers and professional gentlemen, 11 schoolmasters, 1 member of Parliament, and 44 youths under 21; 19 gentlemen are annual subscribers of one guinea. There are 5 daily and 30 weekly papers now provided for the reading-room, the attendance in which has largely increased. The introduction of telegraphic despatches, it is suggested, would add to the interest of the reading-room. The number of books in the library is 2,100, and 500 books have been received from the London library. The total number of issues has amounted to 8,946—a slight decrease on the preceding year. The very handsome donation of 120 vols., by Mr. T. Garfit, in October last, is noticed. There have been 825 issues of these works, and as a table is appended showing the number of times each work has been issued, it gives some idea of the taste of the reading public in Boston. Bulwer Lytton's novels have been in the greatest demand, they have been issued 298 times; Dickens' works rank second, having been issued 127 times; Captain Marryatt's are third, 94 times; Cooper's works have been called for 35 times, Warren's, 25, and Carlyle's, 27. To show how much more the public are interested in history and exciting tales than in more intellectual works, it need only be stated, that while the Cruise of the Midge has been read 17 times, the Ingoldsby Legends 14 times, Southey's Admirals 16 times, and Carlyle's French Revolution 13; Smyth's Lectures on Modern History have only found 2 readers, Ansted's Ancient World and Ruskin's Architecture an equal number. Poetry appears to be a drug, for Longfellow's Poems have only been read 3 times, Bailey's Festus, 3 times, and Macaulay's Lays 5 times, while the same gentleman's Essays have found 16 readers. The committee regret the failure of the attempt to form classes among the young men, but trust that with the increased accommodation in the new building, and the scheme of the Society of Arts of public examinations for the purpose of granting certificates of merit (such certificates to bear a commercial value), will have a beneficial effect. The report concluded by stating that the committee are of opinion that, "whilst in its financial condition the Institution has improved, it has also in its general progress been as satisfactory as, from the very limited accommodation, could be expected. It still enjoys the confidence of the public in a high degree, and although in its present rooms it is not possible to do much by way of extending its usefulness, yet it is gratifying to know that even with this drawback it ministers somewhat to the progress of education, and to the advantage of all classes of the community." At the conclusion of the reading of the address, votes of thanks were proposed and carried to the lecturers, Mr. T. Garfit, president, and the committee and officers.

LONDON AND SOUTH-WESTERN LITERARY AND SCIENTIFIC INSTITUTION.—At the sixth annual general meeting of the members of this Institution, held on Thursday, the 14th February, Mr. F. J. Macaulay in the chair, the report of the committee and statement of accounts for the year ending 31st December, 1855, were read. The report commenced by alluding to the accounts. It was stated that for the future it was proposed to keep the Institution and the School accounts perfectly distinct and separate. The report then went on to say that the committee do not desire to see a large balance to the credit of either account, believing that the interests of the Institution would be better consulted by a generous distribution of its funds, on such legitimate objects as might come within the means of the committee. The committee regret that the classes have not received that support and encouragement to which they are entitled, and they state that should the experience of the current year show no improvement in the receipts of the classes, it will be their duty, with a view to the protection of the interests of the Institution, to discontinue such classes as entail an undue loss upon its funds. The committee then direct attention to the scheme proposed by the Society of Arts, for the examination of classes in connection with Institutions, with a view to the distribution of such certificates of merit among the members as may prove of value to them in whatever profession or employment they may be engaged. The library of the Institution has not lately received any renewals or additions, so necessary to its proper maintenance and development. During the past year 11 lectures have been delivered at this Institution, of which 2 have been on planets, 1 on electricity, 1 on physiology, and 7 on miscellaneous subjects of general interest. In addition to these lectures, there have been 3 readings of Shakspeare and Bulwer, and 3 musical entertainments. The attendance of members and their friends on these occasions has been generally numerous and satisfactory. The evening school is stated to be in active operation. Various resolutions were then passed, the different officers were re-elected, thanks were voted to the railway company, to the committee and officers, and a life membership was conferred on Mr. J. F. Macaulay, in recognition of the long, zealous, and valuable services rendered by him to the Institution as its honorary secretary.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 28th February, 1856.]

Par. No.
53. Post-Offices (Dublin and Edinburgh)—Copies of Correspondence.
62. Poor Law (Ireland)—Returns.
66. Army (Crimea)—Copy of Royal Warrant appointing a Board of General Officers.
46. Bills—Partnership Amendment (Amended).

50. Bills—Secretary to the Poor Law Commissioners (Ireland).
52. Bills—Trial of Offences.
57. Bills—Annuities.

Delivered on 29th February, 1856.

51. Staff Officers—Return.
53. Bills—Summary Jurisdiction.
47. Bills—Joint Stock Companies (Amended).
Criminal Offenders (England and Wales)—Tables.

Delivered on 1st and 3rd March, 1856.

66. Joint Stock Companies—Returns.
67. Sandhurst Royal Military College—Return.
71. Oxford University (University College and Brasenose College)—Copies of Ordinances.

To Correspondents.

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Erratum.—In last No., page 262, line 11, for "*for feeding cattle*," read "*as a dressing for wheat.*"

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Mr. John Ella, "On Vocal and Instrumental Music."
Architects, 8, Mr. G. J. Wigley, "Archæological Studies in Jerusalem."
Geographical, 8½, 1. Mr. W. Kennet Loftus, "Notes of a Journey from Bagdad to Busrah, with descriptions of several Chaldean Remains." 2. Mr. Keith E. Abbot, "Notes taken in a Journey Eastwards, from Sheraz to Fessa and Darab, and thence Westwards by Jehroom to Kaseran, in 1850."
Tues. Royal Inst., 3, Prof. Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½, Mr. Marsden, "On Roman Emperors Egyptian names, &c."
Civil Engineers, 8, Mr. W. Heinke, "On Improvements in Diving Dresses and other Apparatus for Working under Water."
Med. and Chirurg., 8½.
Zoological, 9.
Wed. Literary Fund, 2. Anniversary.
London Inst., 3, Prof. Rymer Jones, "On Entomology and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. George Wallis, "The Recent Progress of Design, as applied to Manufactures."
Graphic, 8.
Ethnological, 8½.
Royal Soc. Literature, 8½.
Thurs. Royal Inst., 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.
Fri. Astronomical, 8.
Philological, 8.
Royal Inst., 8½, Rev. J. Barlow, "On Aluminium."
Sat. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, Professor Odling, "On Organic Chemistry."
Statistical, 2. Anniversary.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette February 29th*, 1856.]

Dated 3rd January, 1856.

28. Hermann Brambach, Cologne—Converting dry pitch, and other resinous substances, also coal tar and other tars, into neutral essential oils.

Dated 2nd February, 1856.

280. James Townsend Ward, Swansea—Improved omnibus.
283. William Joseph Curtis, 1, Sebbon-street, Islington—Improvements in machinery for excavating land for the constructing tunnels.

Dated 4th February, 1856.

296. Richard Clarke Pauling, 18, Great George-street, Westminster—Expelling water from vessels and keeping them from sinking, raising sunken vessels, keeping water out of coffer dams, caissons, foundations, or vessels, or works that are below water, and propelling vessels on and through water.
297. Rudolph Bodmer, 2, Thavies-inn, Holborn—Improved lubricating oil. (A communication.)
298. Elisha Smith Robinson, Bristol—Improvements in machinery for lithographic and zincographic printing.
299. Charles Henry Hudson, 4, Highbury-cottages, Holloway-road—A retiring door or lid for boxes, cabinets, closets, rooms, carriages, and for all places or receptacles where or in which doors or lids are at present in use or may be used.
301. Edwin Clark, 24, Great George-street, Westminster—Improvement in the apparatus for suspending insulated electric telegraph wires.
303. John Thomson, Newton-le-Willows—Improvements in centrifugal apparatus to be used in the separation of liquids from granular and crystalline matters.
305. William Allen Turner, 125, Wood-street, Cheapside—Improved preparation or mixture to be used in the manufacture of compounds of india rubber or caoutchouc.

Dated 5th February, 1856.

307. George Cumins Thomas, Washington, U.S.—Improved method of hardening and tempering steel. (A communication.)
309. Thomas Hinchliffe, Mill-bridge, Liversedge—Improvements in machinery or apparatus for "drawing" and "spinning" wool or other fibrous substances, or wool mixed with other fibrous substances.
311. Theodore Bergner, Philadelphia, U.S.—Embossing veneers, so as to represent carvings in wood. (A communication.)
313. James Howard, Bedford—Improved apparatus for making moulds for castings.
315. Alfred Augustus De Reginald Hely, 296, Oxford-street—Improvements applicable in the burning of gas.
317. Henry Squire, 41, Ludgate-hill—Improved seal or fastening for envelopes, deeds, and documents.

Dated 6th February, 1856.

319. Joseph Thomas, Finsbury-square—Improvements in the manufacture of soap from the greasy matters obtained from the refuse water, wash, or suds, used in woollen or other manufactures or processes. (A communication.)
321. John Fletcher and William Fletcher, Salford—Improvements in the construction of weighing cranes and other similar elevating machines.
323. Henry Alfred Jowett, Kentish-town—Improvements in railway breaks and carriages, and in signals connected therewith.
325. Thomas Frederick Tyerman, Weymouth-street, Portland-place—Improvements in apparatus to be applied to omnibuses and other carriages for receiving wet umbrellas.
327. James Edward Duyck, Wandsworth—Improvements in the manufacture of oil cake.
329. James Meacock, Snow-hill—Improved means of fixing diaphragms in gas meters.

Dated 7th February, 1856.

331. Theodore Bergner, Philadelphia, U.S.—A new mode of preparing or facing surfaces of engraved or etched plates of metal, or other substance, so that they may be readily printed from by a press without wiping. (A communication.)
333. Richard Archibald Brooman, 166, Fleet-street—A method o obtaining alcohol from the fruit or pod of the Carob tree. (A communication.)

Dated 8th February, 1856.

335. John Woodman, Manchester—Improved telegraph insulator.
336. Theophile François Trocard, Bordeaux-town—Improved coffee-pot.
338. Henry Alfred Jowett, Kentish-town—Improvements in rails used for the construction of the permanent way of railways, and in the means of laying down and fixing them in conjunction with the present rails in use.
339. Stewart Robertson and James Howden, Glasgow—Improvements in machinery or apparatus for driving piles.
340. Charles Walker, Glasgow—Improvements in safety valves and in apparatus for cleansing or purifying water in steam-boilers.
341. John Billington Booth and James Beckett, Preston—Improvements in machinery for preparing and spinning cotton, wool, and other fibrous materials.

Dated 9th February, 1856.

342. Charles Swan and George Frederick Swan, 49, High-street, Southwark—Improved colouring matter for writing, staining, or dyeing, which is also applicable to the production of a copying fluid. (A communication.)
344. George Walles, 10, Palace-row, New-road—Improvements in the construction of valves for regulating the passage of gas and other fluids.
346. John Rawlings, Bishopsgate-street—Improvements in envelope or stationary cases.
347. Edward Martin, Oxford—Improvements in cricket-bats.
348. Theophilus Burton, Lincoln—An internal boiler cleaner or mud stirrer for the effectual cleaning of steam-boilers from muddy deposits and all kinds of sediments.
350. Louis Schwartzkopff, Berlin—Improvements in apparatus for raising mud and soil from the bottoms of rivers and other waters.
351. William Augustus Bullard, Dedham, Massachusetts, U.S.—Improvements in instruments for fastening doors. (Partly a communication.)

Dated 11th February. 1856.

352. Christophe Muratori, Paris—Improvements in the waterproofing of hangings or ornamenting stuffs.
353. William Horatio Harfield, 113, Fenchurch-street—Improvements in the manufacture of metallic screw nuts. (A communication.)

Dated 12th February, 1856.

356. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of malleable or bar iron and steel.
358. George Tomlinson Bousfield, Sussex-place, Loughborough-road—Improvement in treating fats and oils. (A communication.)
360. Felix Pruss Jablonowski, Brussels—A new process of chromo-lithographic painting on glass, porcelain, clays, lava, and other materials susceptible of vitrifaction, and on all metals and metallic compounds capable of receiving an enamelled surface.

Dated 13*th February*, 1856.

362. Pierre Isidor David, Paris—Improvements in the method of bleaching.
364. Louis Vignat, 3, Place des Victoires, Paris—A regulator-compensator for the weaving of ribbons and cloths.
366. Samuel Fox, Stocks bridge, Peniston, York—Improvements in springs for railway and other carriages.
368. William Gilchrist, Kirkintilloch, Dumbarton—Improvements in ornamental weaving.
370. William Edward Newton, 66, Chancery-lane—Improvements in the construction of fire-arms. (A communication.)
372. Henry Fort Mitchell and William Mitchell, and John Clarkson, Silsden, near Keighley—Improvements in sewing machines.
374. Gustave Louis Keller, Paris—A new kind or system of carpet or travelling bag.

Dated 14*th February*, 1856.

376. Thomas Parkinson Capp, 67, Gracechurch-street—Improved lamp.
378. Henry Robert Ramsbotham and William Brown, Bradford—Improvements in combing wool, alpaca, cotton, and other fibrous substances.
382. George Pate Cooper, 18, Sutherland-square, Walworth—Improved shirt collar.
384. William Hammond Bartholomew, 15, Brunswick-terrace, Leeds—Improvements in propelling vessels when screws or submerged propellers are used.
388. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in impregnating wood with preservative and colouring materials, and in apparatus for that purpose. (A communication.)
390. Edouard Deiss, Paris—A method or methods of, and apparatus for extracting oils, fats, greases, and resins from bones, raw wool, seeds, and other substances containing the same, and recovering a certain agent employed in the process.

Dated 15*th February*, 1856.

392. Alexandre Tolhausen, 7, Duke-street, Adelphi—A machine for cutting articles of polygonal figure in wood or other material. (A communication.)
394. James Hogg, junior, 4, Nicolson-street, Edinburgh—Improvements in the manufacture of envelopes and certain other combinations and applications of paper and gum, denominated "Letter Checks," for containing and securing written, printed, or other communications.
396. Eddlestone Elliott, Cyrus Leach, and James Ratcliffe, Rochdale—Improvements in machinery for spinning wool and other fibrous substances.
398. William Edward Newton, 96, Chancery-lane—Improved machinery for making boots and shoes. (A communication.)

Dated 16*th February*, 1856.

400. Frederic Daniel Grant, Newgate-street—A method of rendering printing inks and wax odoriferous.
402. George Harrison, 4, Little Goodwin-street, Hull—Improvements in axles for railway carriages.

Dated 18*th February*, 1856.

406. James Strang Thomson and Andrew Barclay, Kilmarnock—Improvements in printing and embossing textile fabrics and other surfaces, and in the production of apparatus to be employed therein.
408. Moses Jones, William Broad Rowe, and William Perrins, Broad-street, Worcester—Improvement in ranges.
410. William Hale, Swan-walk, Chelsea—Improvements in propelling boats or other floating bodies.

Dated 19*th February*, 1856.

412. Henri Gerbaut, Mulhouse—Improvements in the manufacture of vinegar.
414. Frederick Austin Spalding Witter, Manchester—Improved stove. (A communication.)
416. Stephen Fitchew Cox, Bristol—Improvements in the manufacture of leather, and in machinery for that purpose.
418. John Gedge, 4, Wellington-street South, Strand—Improvements in pumps. (A communication.)
420. William Gwillim Merrett, 49, Leadenhall-street—Improvement in trowsers and drawers.
422. Richard Waygood, Newington-causeway—Improved portable laundry, or combined boiling, washing, mangling, and drying and ironing apparatus.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

423. William Aristides Vérel, Macduff, Banff—Improvements in grinding or pulverizing hoofs and horns, and in using them alone or mixed with pulverized bones for manure.—20th February, 1856.
481. Louis Arnier, Marseilles—Improvements in condensing hot air and obtaining motive power therefrom.—25th February, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed February 29*th*, 1856.

1953. John Hanson.
1955. James More.
1959. Charles Frederick Stansbury.
1968. George Frederick Rose.
1971. Matthew Butcher and Thomas Henry Newey.
1977. Thomas Symes Prideaux.
1979. Alfred Vincent Newton.
1983. George Thomas Holden and Richard Nicholas.
1984. Thomas Joseph Larmuth and John Smith.
1988. William Henry Zahn.
1991. John Humby.
2017. Christopher Penrhyn Aston.
2053. Henry Bull.
2059. Etienne Charles Zacharie Bouchard.
2083. Henry Chandler.
2085. David Hill.
2103. Charles Tilston Bright and Edward Brailsford Bright.
2207. Richard Archibald Brooman.
2335. William Glass.
2404. Joseph Hands.
2425. James Gray Lawrie.
2628. Henry William Wimshurst.
2706. Edward John Davies.
2723. Samuel Garn.
2863. Alfred Vincent Newton.
2889. John Watson.

Sealed March 4*th*, 1856.

1999. Thomas Taylor Coniam.
2008. William Craymer.
2013. Joseph Gilbert Martien.
2014. Ichabod Nettleship.
2016. Theodore Schwartz.
2021. George Lowry.
2036. Anguish Honour Augustus Durant.
2038. Anguish Honour Augustus Durant.
2040. Anguish Honour Augustus Durant.
2042. Henry Webster.
2956. François Honoré Lebaigue.
2086. William Sangster.
2088. David Zenner.
2110. William Warren.
2116. Richard Archibald Brooman.
2130. John Moreton Machinton.
2157. Charles Victor Théry.
2180. Charles Ratcliffe.
2281. Robert Henry Kay and Alfred Thomas Richardson, and George Mallinson.
2315. James Fraser.
2580. Duncan Morrison.
2727. Joseph Barling.
2798. Reuben Levy.
2803. Samuel Clarke.
2875. George Harvey.
2884. John Barcroft.
2922. Sylvanus Sawyer.
2946. William Lange.
10. Richard Albert Tilghman.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

February 25*th*.

477. William Symington.
571. Thomas Weatherburn Dodds.
574. Thomas Weatherburn Dodds.

February 26*th*.

514. John M'Adams.
535. Samuel Colt.
538. Samuel Colt.
654. Samuel Colt.
719. Charles Augustus Holm.

February 27*th*.

522. Edward Duke Moore.

February 28*th*.

525. Robert Waddell.
526. Marcel Vetillart.
542. Thomas Crick.
562. Richard Barter.
594. Samuel Blackwell.
595. Samuel Blackwell.

February 29*th*.

510. William Edward Newton.
592. James Kimberley.

March 1*st*.

532. Robert Barclay.
75. Augustino Carosio.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3813	March 4.	The Combined Copying Press and Inkstand	Sampson, Mordan, and Co.	22, City-road, London.
3814	March 5.	Cliver or Hariff Apparatus	William Sawney	Beverley, Yorkshire.
3815	March 5.	Improved Elastic Boot Fastening	Butterworth and Co.	2, New Dover-street, Southwark.

Journal of the Society of Arts.

FRIDAY, MARCH 14, 1856.

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THIRTEENTH ORDINARY MEETING.

Wednesday, March 12th, 1856.

The Thirteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 12th inst., Henry Cole, Esq., C.B., Vice-President, in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Babb, George.
Crossley, Frank, M.P.
Fauntleroy, Charles.
Holmes, James.
Lewis, Arthur J.
May, Samuel.
Parkes, Samuel Hickling.
Schuster, Leo.
Scott, James.
Stainton, Henry Tibbats.
Thomas, John Evan, F.S.A.
Watson, Charles.

The following Institution has been taken into Union since the last announcement:—

411. London, Royal Polytechnic Institution, Regent-street.

On the table were exhibited—

Three volumes prepared for the Paris Exhibition, with a view to represent the state of the manufacture of paper in all its branches in Great Britain. The specimens in Vol. I. were all manufactured at the Mills of Mr. T. H. Saunders, of Dartford, and are divided into three classes:—

Class A.—Hand-made account-book, drawing, and writing papers.

Class B.—Machine-made account-book, drawing, writing, and printing papers.

Class C.—Special papers; plain and elaborately water-marked; adapted for bank-notes, cheques, scrip, shares, and similar documents.

Vol. 2. Class D.—Comprises specimens of paper which may be considered the raw materials of other manufactures, or require some further operation before consumption.

Vol. 3. Class E.—This volume contains samples of all the various packing and wrapping papers.

In the first volume are inserted a short historical notice of the manufacture, and a description of the processes and machinery employed, illustrated by two large plates, one of the hand, the other of the machine, process. The design of the border, printed in gold, is composed of plants, as the cotton, flax, hemp, papyrus, and palm, from the fibres of which writing materials have been formed in different ages. These volumes have been presented to the Government for the use of the Department of Science and Art.

The paper read was

RECENT PROGRESS IN DESIGN, AS APPLIED TO MANUFACTURES.

By Geo. Wallis, Head Master of the Government School of Art, Birmingham.

It cannot fail to be interesting, and may certainly be useful, to note from time to time the progress or otherwise which, as a nation, we may be making in any special phase of art or science. Merchants and manufacturers have their periodical stock-taking, by which they ascertain the precise position of their affairs, consign out-of-date productions to the limbo of "job-lots," clear their warerooms of goods which do not improve by keeping, and get rid of dead stock for the benefit of living capital. This is a wholesome process, which, judiciously applied, may have a healthy tendency on the action of other affairs beside those of commerce, and might be used much oftener than it is to test gain or loss in matters of education, alike national and individual.

For some years past efforts have been made to impress the manufacturers of this country, as producers, and the people as consumers, with the value of art as applied to trade; and although the former generally repudiate all interference between them and their customers, yet it so happened that some 20 years ago the utter neglect of almost everything which tended to give refinement to the forms in which articles of every-day use were furnished to the public, attracted the attention of a few artistic and scientific busy-bodies, who could not understand why ugliness should be so much more economical than beauty, and who even had the hardihood to declare that the latter was as cheap as the former, and *much better!* Strange to say, recent experience has confirmed these people in the conviction thus expressed, and has even carried them further, for they now declare that beauty is much *cheaper* than ugliness, when the principles of art are understood and judiciously applied. It is scarcely to be supposed, however, that everybody is as yet convinced even of the truth of the theory that beauty is as cheap as ugliness; but we certainly have progressed to the point at which art, as applied to manufactures, is really thought to be worth something, since in nearly all manufacturing pursuits into which decoration enters as an element, there has been an attempt, more or less successful, to improve upon past forms and embellishments. It has been found, too, that the markets have not stagnated because goods were a little prettier than formerly, and it has even been hinted at, though this is looked upon with suspicion as a dangerous commercial heresy, that public instruction in art, by means of lectures, schools of art, art publications, and the free access to galleries of works of art, has had something to do with this change, which it is now confessed has come over the spirit of the home market, in relation to the ornamentation of articles of every-day demand.

During the initiation of this change, those engaged in urging it forward have generally found two very opposite influences at work, each tending to counteract a really healthy development of the art-power of the country. One of these influences came out of the determined enunciation by the ultra-practical manufacturer, of the dogma, that all art, as applied to trade, was useless, unless it could be proved that it would "sell," whilst at the same time the proof by trial was refused. The other opposing influence was to be found in the apathy or antagonism of those who, looking upon art as little better than an elegant abstraction, intended only for the use of the wealthy and the wise, denounced all application of its principles to the utilities of life or to the purposes of trade and commerce as an unrighteous attempt to vulgarise it. By the manufacturer popular art was considered as an impertinence, by the connoisseur *par excellence*, it was regarded as a profanation.

It was thus between these two horns of a dilemma that the advocates of art-education had to steer at the outset. It is all tolerably plain sailing now, since fashion has rendered the constant movement of the producer a necessary part of his existence; but it was not always so, and reminiscences of wrathful manufacturers, and still more angry shopkeepers, whose customers had dared to have an opinion of their own, even though obtained at second-hand, will, at times, present themselves. Thus one has sometimes been compelled to listen to a statement how two customers, who had attended a lecture on art the night before, had impudently dared to call the last new design for a chandelier, "a brass gooseberry bush turned upside down;" and worse still, one has been compelled to father and defend the principle of the criticism, and declare that the said chandelier *was* more like an inverted gooseberry bush than anything else in creation. Then the complaint that, "Really the women were getting so particular about the dress patterns," that in spite of the last new *de laine*, printed in 400 colours by the agency of an unlimited number of blocks or cylinders, they could not be induced to buy, since they had got a notion from some pragmatical art-critic, that a lady's dress looked none the better for reminding the beholder of *fourteen* yards of rainbow done in wool!

Happily these small miseries, arising out of the action of a spirit of innovation upon the established interests and vested rights of the British public in ugliness, are rapidly vanishing, and it would be at once ungenerous, as it would be unwise, to expect the manufacturer to make, or the shopkeeper to keep for sale, goods which the public are not sufficiently educated in art to appreciate. Our complaint rather refers to the pertinacity with which too many set themselves up as arbitrators for the public, and decide what it shall *buy*, inasmuch as they will not make or keep anything except what they consider good to *sell*. Their standard being frequently very much lower than that of their customers; hence the constant complaints of the latter. This is, in itself, some evidence that the consumers have a perception of an abstract excellence beyond the reality submitted to them, and this fact has had much to do with that recent progress in design which it is intended to specifically indicate under various industrial heads in this paper.

All are tolerably well agreed that some progress has been made, especially within the last three or four years, although there is no doubt a considerable difference of opinion as to the real character and value of that progress. Many persons, looking from the manufacturer's point of view, will ask, "Do the articles in which improvement is most manifest *sell* better?" Viewed as seen by the merchant and shopkeeper, the question will probably be as to increased profit, whilst from the ultra-artistic point of view, it is more than probable that it will be disputatiously declared that the movement made is no improvement, because it is not in precise conformity to some abstract principle in which the question of realization by an economic process is considered as altogether a secondary matter, or, it may be superciliously maintained that English design means absence of all true art, and that the less we trouble ourselves about the matter the better, since they manage these things more wisely in France! Again, the lover of antiquity, who affects ancient types and methods, and believes that all the labour-saving inventions of modern times are so many mechanical abominations, to be repudiated by all earnest and true spirited art-workers, forgets altogether that the question of mechanical power is only one of degree, since the hammer, the file, and the chasing tool are mechanical contrivances for facilitating labour which could not be executed so well or so speedily by more primitive means.

The secret of all this horror of stamping, electro-depositing, printing, power-loom weaving, and so forth, lies, it is to be feared, in the fact that the almost exclusive possession of a work becomes impossible. Duplication spoils that flattering unction which your pure and legitimate connoisseur lays to his soul as to the uniqueness of his treasure. The beauty of a fine work may be a joy to others as well as himself, therefore he loaths the vile, short, cheap, and ready processes by which this is effected. But then it is argued there is such a sameness in these mechanical reproductions, the charm of variety is wanting, and a sensation of commonness takes the place of that of rarity, and this everlasting repetition of the same form is a traitorous use of art. As if, because green peas are so much alike, a love of *petit pois* is treason to good eating; or because the individual sheep of a flock so strongly resemble each other, there is to be an universal repudiation of mutton.

If modern art, whether applied to industry or the higher illustrations of the power of the beautiful, is ever to make a distinct place for itself in the coming time, it will be out of the wise and perfect use of those mechanical means and appliances with which an All-wise Providence has seen fit to furnish mankind for their use in this age; and it is fearlessly asserted, that he is a negligent worker in the present, and a betrayer of the interests of the future, who does not avail himself of every means which modern invention and discovery affords him to reproduce, in suitable form and material, such beautiful objects of art-manufacture as shall tend to the refinement and instruction of his fellow-men. Nay, more; if he loves the past and those earnest workers of the olden time whose examples he quotes, let him be told that had they had the means at their disposal for shortening their labour, extending its sphere of action, and enabling them to do the work of two, ten, perchance twenty lives in one, he pays but a poor compliment to their earnestness and their love of art, to tell us that they would not have availed themselves of them. They did their work in their way, and that, too, the best which their age and opportunities afforded them, and we certainly follow in their spirit much more by doing our work in and for our own time and wants, and consequently in our own way; thus doing as they did, using all the means afforded us, and not going back to obsolete methods, and tying ourselves down to processes which, though the best when they were used, are no longer *the best*.

All this has been said in order at once to repudiate all test of recent progress by methods rather than by results. It is the complete fact in the work itself with which we have to deal, not whether a man pottered for a month over a piece of work with a hammer and chisel, or struck it out at a blow with a die and press, cast it in a mould, or deposited by voltaic action. Nor, on the other hand, can the most beautiful scientific or mechanical process be admitted into the consideration of the merits of the result obtained thereby, certainly not as any excuse for defects.

It is proposed, for convenience and brevity, to divide the subject under consideration into four special sections, with a fifth, which may be termed supplementary. These may be stated under the heads of design as applied to Textile, Fictile, Vitreous, Metallic, and Miscellaneous manufactures. This classification, if not scientifically correct, yet in such a summary as this paper is necessarily confined to, gives the advantage of breadth of view and ease of reference.

Commencing with

TEXTILE MANUFACTURES

the first point to consider is the recent tendency of public taste, indicative of the nature of the demand which the manufacturer has been called upon to supply. In dress goods, this tendency has been most decidedly towards plain-dyed or self-coloured goods, or such as presented comparatively little variation from the effects producible by shades of a single colour; and, although in the majority of instances it is feared that the character of the ornamentation has been generally such as could not be called either artistic in design or treatment, yet it is something to have arrived at a point at which great contrasts in colour are rather the exception than the rule. The best class of Yorkshire wool and mixed fabrics present features in design which contrast favourably with goods of a similar class manufactured five or six years ago.

In calico prints, except of the highest and best class, or of the very simplest and plainest madders, the change appears rather for the worse than otherwise; yet good authorities in the Midland Counties, at least, say that the great mass of the people who usually buy these things prefer the smaller, neater, and more simply coloured designs, to the blotchy abominations which used formerly to be sought after, and which, in too many instances, are still presumed, by the less observant manufacturer and retailer, to constitute the taste of the working classes. Taking Birmingham as an example, it may be stated, without hesitation, that the neater and more elegant designs in cheap calicoes are most in demand. Taking the opinion of one of the best authorities on this subject in Europe, given the other day at Manchester, it would appear that whilst the printer and engraver are both anxious to do better things, they are persecuted into the production of uglinesses of such a character, that the workmen who have to engrave the cylinders look upon them with disgust, and often declare, in language more expressive than polite, on beginning a new pattern, that, "If the fools had tried to produce an uglier thing, they could not have done it." In short, design, as applied to a large portion of the British calico print trade, just now appears to be literally "a thing of shreds and patches"—mixtures from old pattern books, heterogeneously hurled together at hap-hazard, without regard to purpose, unity of effect, or any other constituent of an artistic design. As a matter of course, the houses with established reputations for the production of the better class of patterns, which come out in neat, simple, and perfectly textile effects, producible in madders—pink, lavender, and chocolate, or in half-mourning prints, keep their ground, and their customers, and "pooh pooh" artistic design as a useless thing to the nation, except so far as it cultivates the general taste of the people to the full appreciation of the simple ornamentation which they have the good sense to employ. To educate the consumer up to this point, is a laudable thing; but to urge the producer to aim beyond these is commercial treason; as if we, as a manufacturing nation, are not more employed in production than consumption; whilst in our home trade the producer of one article is the consumer of another, and it is more than probable that the exact standard of taste to which the producer manufactures is that to which he will appeal as a buyer.

In silks there is a decided progress in design, as applied to some classes of goods, and these, too, of the cheaper kind, and, consequently, most in demand. The Spitalfields productions exhibited at Paris gave evidence of this, and, although Macclesfield was not adequately represented in the Universal Exposition of 1855, a recent visit to the manufactories of that town has proved in a most satisfactory manner that a quiet but steady progress has characterised the designs brought out at Macclesfield during the past three or four years. The ultra-imitation of natural objects is gradually giving way to more severe ornamental forms, which, if not always of the true textile type, are yet geometric in character and precise in form. Two or three specimens of the successful application of the most tasteful of these in neckerchiefs are now exhibited, and there is little doubt of their being highly successful in the market. It has been thought worth while, too, to select one as an example of the influence which the Macclesfield School of Art is exercising. The designer of this, in the employ of one of the largest houses, formerly dealt largely in peacocks, cottages, butterflies, and other eqully absurd subjects, as decorations *suited* to the angles of a lady's neckerchief. They have given way under the teaching of the school, in this instance at least, to floral arrangements upon a geometric basis, of which the specimen produced will give a fair idea. Formerly the Macclesfield silks were more noticeable for the gaiety and contrast than for the taste or their colouring. Checks and stripes are, undoubtedly, a severe test of the power of the manufacturer to combine tints judiciously; and the mania for introducing these in great variety often led and still leads to strange effects. At present there is a decided preference for two, or at most three, tints; and even in the combination of more than these, failure seems to arise more from an uncertainty as to the proportional quantity of each, than in the tints or colours brought together. This is a great step, inasmuch as the question of quantity is simply a question of numbers when properly studied and rightly applied.

In furniture silks the designs of the last three or four years appear to have been based upon much sounder principles than formerly. Geometric forms, and the severer elements of the generic styles of ornament, have been introduced, not only with success, as regards the artistic result, but also as regards their sale. In fact, as a whole, there are few departments of industry into which design enters as an element in which there has been a greater change than in the various textile fabrics used by upholsterers. Without asserting that this change is universal, for it is not, it may be safely stated that successful efforts have been made to introduce a more suitable style of decoration; and designs which five or six years ago would have been pronounced too architectural and stiff, are now not only manufactured, but sold in great quantities. In curtains and table-covers, for instance, either plain surfaces, with borders of an elegant character, as compared with those in vogue eight or ten years ago, are preferred to the "all over" patterns, which were pronounced as the only things which would ever *sell* in the English market. Where it is not desirable to have blank surfaces of colour, powderings in geometric, or, at least, severely symmetrical forms are frequently introduced, either by embroidery or by weaving. Nor is this tendency to the use of more tasteful drapery in furniture confined entirely to the costly productions. An eminent Manchester house has, in connection with their productions in silk and embroidery, introduced, with great success, printed borders for curtains, the majority of the designs for which are of a severe type in form and colour, chiefly frets and gulloiches in one colour, or at most two. A few of these borderings have also been designed to meet the views of those who think that all severe ornament must be stiff in effect, and that no forms except flowers can be made satisfactory vehicles of a colour. This compromise between artistic principle and the supposed requirements of the market, is certainly not successful as regards the former, and it is to be hoped it will not be so as regards the latter, since manufacturers who really have the enterprise to introduce a good thing to the public, ought also to know that their best interest lies in keeping up the character of these productions alike in design and execution. In embroidery, the ultra-naturalesque forms which prevailed some six or seven years ago, are giving way to a class of design more suited to production by the needle. Much of this is doubtlessly to be attributed to the severe character of the ecclesiastical embroideries, for which there has more recently been so large a demand. In gymps and edgings, too, the character of a trimming has been gradually taking the place of the wiry and unmeaning nonsense which used formerly to be so difficult to put upon a fabric in a satisfactory manner, but which it was still more difficult to keep upon it.

In connection with silks and the question of edgings and trimmings, a few words may be said at once about ribbons. The French have had the credit of producing the most tasteful things in a certain class of silks, and French ribbons have always held a good position. In fact, those of English manufacture have always been looked upon as inferior, alike in make, colour, and design. Now a ribbon, if it is anything, is simply an accessory to something else in dress. It comes in as a rosette, a border, and, in special cases, in the character of a festoon. Floral design, where suitably arranged, is, after all, not so much out of place as some hyper-critics might suppose, since a wreath of flowers is not an unbecoming ornament to a lady's bonnet, cap, or hair. It is quite clear, however, that the best designed ribbon is that which carries out the idea of an ornamentally-arranged border, in which form and colour are so combined, as to give finish to that portion of the dress upon which it is used. Tested by this standard, what becomes of the supposed excellence in taste of French ribbons? And, however gay and often exquisite in point of colour, many of those exhibited at Paris in 1855 certainly were, a goodly number of those now produced at Coventry are superior articles in the principle of their ornamentation. There is one point, however, which must ever be borne in mind, with respect not only to French ribbons, but many other articles produced in France for foreign markets, especially English and American, that a certain standard of ugliness in form, and violence of contrast in colour, producing vulgarity, is essential to suit the peculiar notions of the wholesale buyers, who act as the arbitrators of taste for the British public and that of the United States. Whoever saw a Frenchwoman wearing these party-coloured trimmings? It is certainly no compliment to those who do wear them to be told that the people who make them know better than to wear them, but consider them good enough, artistically, for the barbarous taste of their customers.

In the important articles of linen damasks, whilst a few excellent things have been produced from time to time, by the leading manufacturers, it is feared that no great progress has been made towards a purer style of ornamenting an otherwise beautiful fabric, and that designs in which much excellent drawing is thrown away upon unsuitable subjects, are still produced, and that, too, as specimens of progress. It is, however, something to have got rid of an immense amount of unmeaning ornamentation, whilst specimens of diaper-work for centres, and of symmetrical, if not absolutely geometrical, arrangements in borders, have occasionally made their appearance, which cannot fail to produce a good effect, since they commend themselves by contrast with their more ambitious predecessors.

In cotton quiltings, too, diapered effects are taking the place of costly and ineffective arrangements of form, in which the character of the fabric and its purpose were sacrificed to the whim of a manufacturer, who first gets himself into a difficulty by aiming at the production of some elaborate absurdity, which is generally supposed to be an impossibility, and then finds himself in a still greater difficulty after he has achieved his object, on discovering that he has thrown away time and money upon a work which, from its inconsistency, those who do not understand it are careless about, and those who do understand it condemn. This was illustrated in a few strange things—such as views of the building in Hyde-park—exhibited at the Great Exhibition of 1851; and again in certain attempts at the production of historical subjects in lace exhibited in the Universal Exposition of 1855. The absurdity of this latter attempt was the more glaring from the fact that abundant evidence was afforded that in the lace trade of England, especially in the machine-laces of Nottingham, great progress had been made in design since the International Exhibition in Hyde-park. This was decidedly proved in the cheap curtains exhibited at Paris, in which a fitness of ornamentation was shown which cannot fail to largely influence design as applied to other departments of the lace trade.

In Irish laces and sewed muslins the progress in this respect has been of a marked and healthy character. Setting out from a point at which all needle-work types would appear to have been repudiated, this industry has gradually but surely progressed, so as to stand in such a position at the present time as to fairly challenge criticism in all the higher class of work; and it is probable that as much may be said of a considerable portion of the Honiton lace, as manufactured by and for the best houses. In short, in these, by no means unimportant departments of national industry, in which form in outline or in mass, or both in combination, is alone available, the three common-sense questions:—What is the material? What are the means? What is the use? appear to have had fair-play, and an attempt, at least, at honest solution.

These three questions, if applied to carpets, which must form the last point for consideration under the head of textiles, would, it is feared, receive but a very imperfect and unsatisfactory response. Yet some progress has been made even in carpet designs, which, a few years ago, appeared to be hopelessly abandoned to an incessant ringing of the changes upon artistic pit-falls, man-traps, and floral stumbling-blocks in velvet pile and terry fabrics in wool. A few manufacturers, as also a few dealers, seem to have arrived at the point that, inasmuch as a carpet is a covering for a floor, it ought to look like a floor — that is, a surface to walk upon,— that a carpet is not the only article in a room, and that its lines and its colours ought rather to be subordinate to the more prominent pieces of furniture, than to challenge attention by the brilliancy of its hues in masses, or the tortuosity of its lines in the boundary of its forms. A conviction, too, has arisen that forms in projection are inconsistent with the position of the surface upon which they are represented; and that, even granting that flowers, tastefully, arranged and judiciously treated, are not unsuitable objects for the decoration of a carpet, yet there is no reason why the flower-basket should be represented too.

The statement that floral designs in carpets are still preferred by the consumers, and that the ladies especially, in spite of the best geometric designs, insist upon roses done in wool, is a fair argument enough in its commercial application, but in an artistic sense only proves that the people lack a knowledge of principles by which to test these things. The ladies still buy the Indian pine-pattern shawl, and will probably continue to do so, not from any conviction of its eminently textile character as a vehicle of colour, but simply from association of idea, just as the old willow-pattern plate was formerly, and still is, to a great extent, the only true and veritable representation of popular notions of fictile decoration. It will be thus seen that the admirers of floral design in carpets, and Indian pines in shawls, are at cross-purposes with themselves, so far as common sense is concerned. It is much easier, however, to say, "Out upon your common sense and art-tests too, so long as people buy!" than to prove that the advocates of the application of sound principles are wrong, even commercially, if care is taken to judiciously introduce a purer style of art, without a sudden repudiation of prevailing ideas.

Looking at the probabilities of future progress in textile design, the great stumbling-block appears to lie in the mania amongst large buyers, and even retailers, for *concocting* their own patterns—it would be a libel on all art to call it *designing*. But for this, the probabilities are strongly in favour of a more rapid improvement in the future, since manufacturers themselves are beginning to feel that a knowledge of drawing and the principles of design is of considerable use in the preparation of those patterns with which, if left uninfluenced, they would endeavour to supply the market. So long, however, as the mere agent between the manufacturer and the public is permitted to substitute the traditions of the market for the common-sense principles of art, and empirically dictate what the one shall *make* and the other shall *buy*, matters will go on much as they have done, except that it is just possible the taste of the dealer himself may improve, where it happens that he is not convinced that he is the embodiment of all-perfect wisdom in his own special trade.

Fictile Manufactures.

In no department of British industry has the value of a gradual introduction of improved modes of decoration been more clearly proved than in that of porcelain and ordinary earthenware. To any one who, like the writer of this paper, visited the Staffordshire Potteries nineteen years ago, and observed the state of things at that time, and has had the privilege of an occasional visit at stated intervals during the period which has intervened, it must be very obvious that a change, such as we frequently hear pronounced as impossible in other industries, has come over nearly the whole of the productions of that district. Far from resting satisfied, however, with even the present state of things, it is quite clear that every coming year will tend to still greater progress than that already realised, and that those who pertinaciously persist in the common fallacy that to do as they have done is all-sufficient, will be left behind in the race.

The illustration of the fictile manufactures of Staffordshire in the Paris Exhibition was of such a character as to prove most unmistakeably that a great improvement had taken place since 1851; and, without being prepared to approve, on artistic grounds, of all that had been done, yet, with the experience of the past upon our memory, it would be unjust not to award the credit due to intelligent effort and steady enterprise. To two houses, these of Messrs. Minton and Co. and Messrs. Copeland, the credit of the earlier movements is due; but others have followed who applying a better style of art to less exceptional articles than those produced by these two firms, have certainly aided in no slight degree the more recent improvements; and it is quite evident that at the present time, whatever fault may still be found with the subjects employed for the purpose of decorating the cheaper ware, yet that the character of the art employed is much higher than formerly. In the blue transfer ware, for instance, there is a decided tendency to mosaic forms, less attempt at projection in light and shadow, and although the details are often more architectural than fictile, yet the result is felt to be more suited, alike to the use of the article, the surface decorated, and the method of ornamentation.

In these forms, too, one can trace the influence of the merest elementary outlines in use in our schools of art, of which that established in the Potteries eight years ago has been one of the most practically useful.

In the cheaper kinds of porcelain, neatness approaching severity is gradually taking the place of the blotchy floral designs which formerly disfigured forms which ought to have suggested more tasteful decorations. Nor have the forms themselves been neglected, since in many articles of every-day use, a purity of outline formerly unknown has taken the place of the eccentric convolutions which bid defiance to common sense and the ordinary rules of proportion.

Into the higher class of porcelain painting an artistic refinement has been introduced which contrasts in a remarkable manner with the hard, wiry, and laboured results of some twelve or fifteen years ago. One feels that the workman is more of an artist, and yet not the less of an artizan than formerly.

It may be reasonably asked, to what cause is this change to be attributed? and it may be replied that at one period matters were really so bad that a change was inevitable in order to retain the trade in the higher branches, and there can be no doubt that the efforts after improvement in this direction led to corresponding efforts in the production of less costly articles. The introduction of Parian, however, would appear to have given the first impulse towards a higher style of art. The enterprise which prompted the employment of artistic talent in the production of statuettes, either original or as reductions from celebrated works, modern and antique, was soon engaged in the improvement of analogous branches of fictile art. The key-note was struck in Parian, but the theme has been carried out step by step in other materials and modes of application, such as tiles, vases, garden decorations, and domestic services.

Recently the efforts to emulate the productions of Palissy, and rival the *Majolica* of the best periods, have been attended with so much success, that he must be a hyper-critic indeed who would not join in a congratulatory compliment to the skill which had solved the problem of modern progress in British fictile art, so successfully.

In thus endeavouring to do justice to the progress made in the Staffordshire potteries, the productions of Worcester must not be forgotten. In 1846, a first visit to this city showed the writer how much in arrear its porcelain manufacture then stood, even as compared with that of Staffordshire. Since that period a marked improvement has taken place, and "the faithful city" bids fair to resume its old position, and even excel it, in the manufacture of the higher class of porcelain. Here, again, the influence of reproductions in imitation of past modes of decoration has had its influence, and the imitation of Etruscan methods in the manufactory of Messrs. Kerr and Binns, followed as this has been by the successful production of admirable specimens, which go far towards rivalling the best class of *Limoges* ware, cannot fail to influence other departments, and stimulate to corresponding improvements. Good work of any kind always has this healthy influence, that it renders the mind impatient of that which is less perfect, and thus imperceptibly necessitates progress. In this fact lies the value of bringing fine works of art of every kind before the people. The mind once imbued with a true sense of the beautiful, detects at a glance any anachronism in form or colour, although the "why and wherefore" of the defect may not be so readily discovered. This can alone come of sound education and a knowledge of principles.

Let it not be supposed, however, that all recent progress in fictile art is confined to reproductions and imitations of antique types or methods. During a visit, the other day, to the Staffordshire potteries, two new modes of decoration presented themselves. Of one of these, specimens are forthcoming. This consists of an inlaid coloured body upon Parian, and seems admirably calculated, from its conditions, to necessitate severity in ornamentation. The process has been so far worked out by Messrs. Rickuss and Toft, and is of an economical character. Of the other process, now in the course of development by Messrs. Pratt, no specimen has, unfortunately, being forwarded, owing, as it would appear, from the proprietors not being at present prepared to bring it before the public. Some admirable things, however, are in progress, and, judging from a complete specimen, the results appear likely to be of a very satisfactory character. The process consists of enamelling upon terra-cotta, the outline of the ornament being printed by transfer, and the colours afterwards put in with a brush.

Having thus briefly sketched the progress of design as applied to fictile manufacture, the next and somewhat analogous section of our subject presents itself,

Vitreous Manufacture.

It may, perhaps, be said that all progress in the manufacture of glass in England during the last 200 years has been recent, since our fiscal restrictions completely kept an important branch of industry aloof from any contact with modern science and art until within a comparatively short period. Good use, however, has been made of the interval, and except that in some departments there still exists an affection for weight of metal and deeply cut facets, rather than a desire to produce pure forms with appropriate ornamentation, the glass trade of Britain has made extraordinary progress in many points, and in none more than the production of a good character of cheap glass, in which, if there is no very remarkable development of beauty, there is certainly nothing very offensive as regards either form or decoration. There is one point, however, which nearly all modern glass manufacturers of every country appear to neglect, and this is the crystalline nature of the material, and the necessity for adapting the ornamentation so as to make the most of what may be termed its inherent beauty. This is frequently proved in the results obtained in "*pressed*" glass, in which the conditions of manufacture compel the manufacturer to study the material. The effects produced, though often crude, and, viewed from a merely mechanical point of view, unsatisfactory as regards finish, are yet so admirably adapted to the material as to commend themselves in spite of other drawbacks.

Perhaps the best illustration which could be given of the value of this adaptation of form and ornamentation to the character of the material, was to be found in the candelabrum exhibited by Messrs. Osler, of Birmingham, in the Paris Exhibition, which contrasted so favourably with works of a similar class exhibited on that occasion. In this work a thoroughly crystal type was followed throughout, by means of an arrangement of prisms and cutting in facets. The contrast it thus presented to similar works contributed by the French was remarkable.

In these specimens, the usual compliment of scroll work, brackets, bosses, and imitations of acanthus foliage, were to be found; and their inconsistency became only the more apparent from comparison with the English candelabrum, in which these details were studiously avoided, whilst the result was far more brilliant and ornamental. In fact, the inappropriateness of architectural details, the value of which as ornaments consists in their outline, and the effects resulting from a play of light and shadow, being applied *to*; and *in* a material in which the effects are obtained mainly by light in transition, is at once obvious; if that very simple, but much neglected, question, as to the nature of the material to be used, is ever fairly asked and honestly answered.

In coloured glass there can be no doubt much improvement has been made of late years; and, without exactly maintaining that the Bohemian standard has been reached, it may safely be affirmed that where care has been taken not to attempt too much, some of the articles in coloured glass produced in Birmingham are of a very tasteful and pleasing character.

In stained glass for windows, the progress in England has been of a very remarkable kind. From an exceptional employment, the manufacture of decorated windows has become a general one; and although the best works yet produced have been either copies of old windows, or based upon ancient types, yet, as the beginning of a revived industry, there is more upon which to congratulate ourselves than to condemn. Those who are impatient of results, and see no reason why the oak cannot be grown as rapidly as the mushroom, will perhaps object to this. Let it be so. All really permanent results take time to develop themselves.

Metallic Manufactures.

In the wide and constantly extending field of the fancy metal trades of Great Britain, the opportunity for progress in design is so great, that, with much to regret and find fault with, there is also much which cannot fail to satisfy and encourage all who take an interest in the application of art to industry. Perhaps the greatest revolution in the higher departments of design, especially as applied to gold and silver, has arisen out of the great modern discovery in science of the deposition of metals by galvanic action. A few specimens of high class productions in electro-metallurgy, by Mr. Edmund Heely, of Birmingham, are now exhibited as illustrations of the value of this process in its applications to the reproduction of ancient and modern works in the precious metals and bronze. The opportunity thus afforded for copying or reproducing, at a comparatively reasonable cost, the fine works of past times, has tended to educate the taste of the people, and lift us to a higher plane of judgment in modern productions. Thus, the test by mere material value in bullion weight, which had usurped the place of the esthetic value conferred by art, has been gradually giving way, and the importance of the latter is gradually becoming more and more recognised. This is seen in the character of the works now usually produced for testimonial services and for racing prizes. It is useless to say that these are not always appropriate,—often, indeed, exceedingly inappropriate,—but as an evidence that a desire for something more than a given number of ounces of gold and silver is giving way to some consideration of the form in which the metal comes, they are proofs of progress.

Again, let any person whose recollections of the displays made by our gold and silver plate manufacturers date back some fifteen or twenty years, compare the character of the productions then exhibited in show-rooms with that of some of the leading houses now, and then consider the change. In the show-rooms of Messrs. Elkington, Mason, and Co., of Birmingham, there are at the present time ten times more works, in which appropriateness and purity of design, in connection with excellence of art-workmanship, is displayed, than could have been produced, twenty years ago, by all the houses in England put together.

The progress made in the manufacture of church plate and general metal work for ecclesiastical purposes, as indeed in all matters connected with church ornaments, is well known to all who take an interest in the progress of the arts of design. The manufactories of Messrs. Hardman, of Birmingham, Skidmore, of Coventry, and others, have produced works from time to time, within the last few years, which would have done credit to any country and any age, if the fact is taken into account that the question of cost was a serious element in their manufacture. And here it may be permitted to say a word about the influence which one mind alone undoubtedly exercised, not only on the particular department of art to which he specially devoted his attention, but, indeed, upon all of a kindred character, in which other minds were engaged who could appreciate his arguments, and apply the principles he enunciated. For however much we may differ in many points from the late Mr. Pugin, as to his special views of the mission of art, and the application of modern scientific and mechanical means to the reproduction of works of excellence, his earnest and fearless denunciation of all "shams"—his exposure of false systems of ornamentation—his thoroughly zealous working out, "in season and out of season," of his own views in his own way, must ever command the respect of every true and earnest lover of art, since it is to the influence of his example, in one direction, that we owe so much of the progress to be recorded in other departments of art-manufacture. It is therefore but an act of justice to his memory, which all who differed from him on special points, can at least afford to perform—to fairly and honestly acknowledge how much he did, in his comparatively limited time, for the domestic and manufacturing arts of his country, both directly and indirectly.

That an enormous amount of work is still thrown away upon, comparatively, very indifferent designs in gold and silver is quite true. That the human figure and animals are pressed into service, rightly or wrongly, and that these are often wonderful examples of the ignorance of their producers, is also true. That ornamental types, originally designed for any material but metal, are introduced without the slightest consideration as to fitness, is a fact which is patent to all who interest themselves in this question; yet, with all these drawbacks, and many more not so easy to enumerate, it is affirmed that much has been done during the past few years for design as applied to gold and silver plate and its imitations.

In brass and bronze work the same may be said; for, notwithstanding the ultra-naturalesque character of many productions still in the market, and likely still to "sell," an approximation has been made towards a much purer style, and this, too, since the Great Exhibition of 1851. It must never be forgotten that much of the over-ornate tendency, so visible in the ornamental brass manufactures of Birmingham, arose from a slavish and unmeaning following of the French, especially after the Exposition of 1844. It is satisfactory to know, however, that the present tendency has not its origin in this direction, and that in the brass and bronze chandeliers, gas-brackets, and works of an analogous character, efforts are now being made, and some of them very successful ones too, to work out a more severe style of treatment as applied to those useful articles, and, whilst giving less weight of metal and more hand-work, to produce tasteful results by a little more brain work at the outset. In fact, manufacturers are beginning to acknowledge that artistic talent, carefully directed to practical ends, will *pay* when it secures simplicity and elegance in design. Nor is this applied so much to the costly articles as to those coming within the means of persons of moderate income. In short, the construction required by the use appears to be first considered in the specimens alluded to, and then the-ornamentation is carefully adapted to the embellishment of the necessitated form. This, we apprehend, is sound practice, based upon sound principles. Under any circumstances the results are satisfactory, so far as manufacture goes; and that the articles will make their way in the market in due time, it would be as unreasonable to doubt as it would be to doubt the influence of light upon darkness.

In iron castings, especially those suited to the furnishing of entrance-halls and garden decorations, to quote the display of the Coalbrookdale Company in the Paris Exhibition, will be quite sufficient as an indication of progress in this direction; for without absolutely declaring that everything manufactured by this firm is perfection, one cannot hesitate to acknowledge that the improvement, even since 1851, must be visible to the most careless observer.

In connection with this part of our subject, the remarkable strides in design, as applied to the Sheffield manufacture of stoves, grate fronts, &c., must be noticed. It will be remembered how thoroughly well Sheffield maintained its position in the Great Exhibition of 1851. Since that time great progress has been made, and although this was not illustrated to its full extent at Paris, it is not the less a fact. It is not the less gratifying, too, to know that here, at least, the influence of the instruction given in the School of Art has been acknowledged, and that those who availed themselves of its teachings have sought to do it honour.

Before quitting the section of metallic manufactures, let us seek to do an act of justice to a much misunderstood and grossly abused branch of Birmingham industry—that of jewellery. It has been usual, almost from time immemorial, to describe any article of manufacture, especially in the precious metals, which appeared of doubtful quality or workmanship, under the generic term of "*Brummagem*." This epithet involves the very essence of the term "sham." Unfortunately, on the one side, there has been but too much foundation for the term being understood to represent something at once very pretentious and very unreal, but it is equally unfortunate that on the other side much excellence, alike in design and handicraft, has been misrepresented and misunderstood. It is desirable, therefore, to call attention to the fact, that whilst Birmingham jewellery has made a decided advance within the last three or four years, alike in design and excellence of workmanship, it is not the unreal thing some persons appear to imagine; nor does it follow that, because, as compared with the highest class of jewellery, there is not that weight of metal used which is in itself bullion value only, that the gold used is less pure than in the mere *solid* article. And here it may be desirable to explain the technical use of this word "*solid*." In the Birmingham sense it does not imply that the whole mass of form is filled up with metal, but that all the metal used in the manufacture is of the standard value it purports to be.

In order to illustrate, as far as circumstances would permit, the present state of design as applied to the manufacture of jewellery and ornaments for the person in Birmingham, a small but varied selection has been made from the productions of some sixteen manufacturers, and in order that no article should be specially prepared, all have been collected within the last three days, in some instances from stocks in which very little choice could be exercised, from the constant demand for the articles as fast as they can be manufactured. These will give a general idea of the style and character of the articles now in the course of production for the home market. Of course they are not sold retail as Birmingham make. They are indifferently recommended to the public as "Town made," "Paris made," or as the special productions of Pekin, or Timbuctoo, or any other place rather than of Birmingham! The change in the character of the designs of these productions must strike every person who has paid any attention to works of a similar class as manufactured some years ago. The vulgar contrast of coloured stones, the obtrusive and inappropriate details in the ornamentation, the loose character of the workmanship, have in a great measure vanished; and except that the Birmingham manufacturers have still the traditionary fear of shooting over the heads of their customers, by making their articles too chaste and unobtrusive, it is quite clear, after a careful examination, that as beautiful work, alike in design and execution, can be, and often is, produced at Birmingham as at any other place where the jewellery in ordinary demand is manufactured.

It must, however, be carefully borne in mind that this industry is in a transition state of even more recent date than that of the other manufactures we have noticed, and that, from an intense and unreasoning vulgarity, it has had to make its way to something like fixity of principle and purity of style. In effecting this, the first step has been to make a brooch like a brooch in form; to try to get rid of the conceits so much in vogue, and to appeal to the eye of the purchaser rather by sparkling and brilliant effects in a concentrated form than in the outrageously diffusive contrasts of twisted gold and coloured stones. The revival of the use of the cameo, with its quiet tints and expressive forms, would appear to have had a tendency to produce a still further leaning towards quiet effects, in which thoughtful arrangement and skilful handicraft takes the place of careless redundancy and hurried construction. In some of the signet and ladies' rings, shirt studs and pins, now displayed, the character of the setting is as pure and unexceptionable as the most fastidious person could desire.

It is not, then, too much to assert that a great step has been made in the right direction as regards design as applied to the manufacture of Birmingham jewellery in all its leading branches. Of course in the speciality of imitative jewellery there is the same foundation for distrust as ever, and it is to the reproach of our Registration of Designs law, that the manufacturer of the genuine article is the constant victim of imitators of his best designs in spurious metal: as of course these people do not find it to their advantage to make new designs, but to copy those of a genuine character which have been found most successful in the market.

MISCELLANEOUS MANUFACTURES.

Having thus glanced at the progress of art-manufacture under the four great sections into which it has been thought most convenient to divide our national industry for the immediate object in view, it is now desirable to indicate, before concluding, some evidences of improvement in other manufactures which cannot be said to come within either category.

In the general style of furniture manufactured in England there does not appear to have been that improvement which might have been expected, except probably in the accessories of carved work. In this latter respect there is certainly considerable improvement in executive skill, but as regards the question of its application it is quite clear that we have much to learn on this head. On the production of high-class furniture, the Great Exhibition of 1851 has exercised a decided influence, and since that event works have been successfully carried out which a few years ago would not have been attempted. Still, in all that applies to the supply of the general wants of the people, little change appears to have been effected.

In the manufacture and decoration of Papier Mâché there appears to be a growing tendency towards a more severe style of ornamentation; but this, so far as Birmingham is concerned, has not manifested itself at present in a very palpable form. The facile power of hand displayed by our japanners is often very great, but this is too frequently directed by nothing more than the merest tradition of the workshop. The inventive power, too, of some of the most talented is also very great; but being undisciplined by a knowledge of the laws which govern composition in ornament, they are rather the producers of clever accidents in arrangement, than designers in the full sense of the term. On the whole, it seems probable that the japanning trade will not show more than a gradual approximation to finer styles of ornamentation for some time to come, and that the changes needed and gradually introduced will be rather the result of the improvements in other departments of ornamental industry being taken up from time to time, and adapted to the wants of the japanner and his employer, than from any determinate and well understood effort after original and artistic results as arising out of the study of the elementary principles of decoration.

From the individual character of the production of each of the leading houses in the japanning trade in Birmingham and Wolverhampton, there is evidence enough of an enormous scope for any amount of art-knowledge, as applied to this industry; yet, strange to say, very few japanners know how to draw, and fewer still care to undergo a course of systematic training. So long as this state of things exists, employers may calculate upon little improvement in their manufacture; and with a beautiful material, great facilities in production, almost boundless variety in pigments, gold and silver powders, gold leaf, and pearl, the higher qualities of design will remain dormant for want of educated power in the worker.

The question of interior decorations of buildings does not come within the purpose of this paper, but the manufacture of wall-papers may very properly claim some attention. If any one ever attempts to write a work upon "The Natural History of Ugliness," the paper-hangings manufactured in Great Britain and the United States would certainly stand in the first class of the genus *super-ugly.* Yet, even in this apparently almost hopeless manufacture, so far as regards the probability of anything like artistic influence being brought to bear upon it, a very decided improvement has taken place. Nor is this improvement manifested in the higher class of papers, which, in many respects, are as outrageous in form and colour as ever, as in the cheaper kind; those, in fact, which, being printed by machine, are adapted to the wants and means of the great mass of the people. In these, pretty and effective diapers have taken the place of the strange things which formerly disfigured the paper and the walls upon which it was hung, and in many instances persons of education and taste prefer these simple patterns, even for rooms in which they would desire to place a costly paper, because the result is so much more pleasing than the designs they would be compelled to take in a high-class article. Of course there are exceptions to this tendency to redundant ornamentation in gold and colour in the first-class paper hangings, and, as might have been expected, many of the leading houses of the metropolis take care that attention is paid to the character of the designs they employ, keeping in mind that, beside the carpet and the wall, there are other things in a room which have some little claim to be seen, and that the ladies do not care to be always compelled to dress up to the key-note of colour pitched by a wall-paper of intense brilliancy of tints and powerful self-assertion in the forms of the ornamentation. In fact, there is a lurking suspicion in the minds of upholsterers and paper-hanging manufacturers that, after all, "those fellows who write on art" may not be so far wrong, when they assert that a wall-paper when put in its place should form a decorated back-ground.

There are doubtlessly other manufactures to which attention might be called, but it is feared with very little chance of indicating much progress. Some of these may possibly suggest themselves to others; if so, it is trusted that in the observations to which this brief summary of the present position of manufactures in their relation to art will give rise, these may be mentioned.

One great object of this paper has been to elicit a record of progress out of the remarks which it is to be hoped will be made by others; each, in his own speciality at least, more competent perhaps than the writer to give an opinion, either negative or affirmative. Finally, it is earnestly hoped that the result will be such a comparison of notes and experience as may enable all interested in the subject under consideration to arrive at a satisfactory conclusion,—first, as to what we have done; second, as to what we are doing; and, last, "though not least" in importance, as to what we *need* to do in design as applicable to the great staple industries of our country.

DISCUSSION.

The Secretary stated that he had received a number of communications on the subject of Mr. Wallis's paper from different gentlemen, but as the time at the disposal of the meeting was very limited, perhaps the members would prefer reading them in the *Journal* to his doing so then. (See page 302, *et seq.*) He should state that the Society was indebted to Messrs. Kerr and Binns (late Chamberlain's) for the imitation of Limoges ware; also to Mr. C. F. Hancock (of Bond-street) for the racing plate and higher class of jewellery, including a group in silver, illustrating the death of Lord Francis Villiers, and the unequal contest held by him against the soldiers of Cromwell, narrated in Clarendon's History of the Rebellion; a group in silver, a scene from Sir Walter Scott's "Ivanhoe;" the Templar, Sir Brian de Bois Gilbert, an equestrian figure, accompanied by Prior Aymer, "on his well-fed ambling mule," meeting with Gurth and Wamba, the Saxon serf and jester of Cedric, the Saxon — oxydised; a tazza, or vase, surmounted by an allegorical figure of memory, and two cups of the past half-century, illustrating the progress of design in racing plate during that period; and to numerous Birmingham firms for the loan of articles to illustrate the paper.

Mr. Hyde Clarke wished to make a few remarks upon the observations contained in Mr. Wallis's paper, relative to the influence which buyers had in textile manufactures. He had shown that the buyers stood between the manufacturer and the consumer, and prevented the genuine productions of the former from reaching the hands, or even the sight of the latter—and he held out rather a hopeless prospect of amendment in that respect. But there was one safeguard against it, for the Exhibitions which had been carried out under the auspices of that Society, and the international ones of 1851 and 1855 enabled the manufacturer to bring his own genuine designs before the public at large, free from any extraneous influence. Though Mr. Wallis had only pointed out the textile manufactures as being influenced by this cause, there were other branches of manufacture which had likewise suffered. They saw that the designs which were produced expressly for the Exhibitions, and not for the market, were in many cases highly appreciated by the public and purchased direct from the manufacturer at the Exhibitions where they were exhibited, and their adoption has been forced upon the trade. Now, looking upon those Exhibitions—not as isolated examples which are never to occur again, but as great and permanent institutions—there was great hope for the progress of art in manufacture, and for the means of getting rid of the influence which had been adverted to.

The Chairman said, the paper which had been read was one which must be most suggestive of points for discussion, and he thought there must be many persons present who could not at all agree with what had been laid down by Mr. Wallis, and who would perhaps be good enough to give the meeting their views on the subject. There was one gentleman present who was always listened to, when he spoke on these subjects, with the greatest attention, he alluded to Mr. Ruskin; and perhaps that gentleman would be good enough to favour the meeting with his views as to the tendency of our manufactures at the present time.

Mr. Ruskin was quite sure that the Society must be grateful to Mr. Wallis for the clearness with which he had brought certain facts before them, and he should not venture to contravene the principles which seemed to be involved in the statement, because he was not sure how far certain other principles might be accepted, though not stated, by Mr. Wallis. There were many things which he had stated that he (Mr. Ruskin) should feel it otherwise his duty to oppose, but he thought they afforded rather the materials for a subsequent paper. He would rather request information from Mr. Wallis as to the exact sense in which his principles were to be received, for he could not arrive at any definite notion as to what the general idea of excellence was, by which each branch of art was tested. They had heard, for instance, an ungallant attack upon the ladies for promoting a base manufacture of carpets—admitting the complete imitation of flowers. He could not blame the ladies in this, chiefly because he knew a most respectable and long-established firm, engaged in carpet manufacture on an extensive scale, which conducted its business on the principle Mr. Wallis opposed. He referred to the firms whose head-partners, the months of April and May, supplied a large part of the world with green carpets, in which floral design was largely introduced, and he believed generally to the satisfaction of the public. Nor could he see, since the first thing we usually did to make the ground fit to be walked upon by any festive procession, was always to strew flowers upon it, why we should refuse to have flowers on our carpets, lest we should stumble over them, any more than we should refuse to have pictures on our walls lest we should knock our heads through them; and he was astonished, presently afterwards, to hear Mr. Wallis speak with exultation of success in imitation of Palissy ware, since assuredly, if appearance of projection were wrong in a carpet, real projection must be wrong in a dish. He had profound respect for Palissy, and delighted in his work—as work merely—but of all the useless dishes that ever were invented, Palissy's were the most so. You could not cut your meat on them, you could not get a spoonful of gravy out of them, and if we were not to be allowed to have flowers on our carpets, why were we to be allowed to have vipers on our plates? He wished also to hear from Mr. Wallis more explanation of his (Mr. Wallis's) meaning in saying that beauty was as cheap as ugliness. In a certain sense it was so, as referred especially to manufactures which might be multiplied by machinery; but there were some kinds of manufacture which could not be multiplied altogether by machinery. He repudiated in all earnestness the allegation of not wishing that noble works of art should be brought before the public. He could only say, that he had taken a great deal of trouble, and gone to considerable expense for the purpose of getting the best he could of Turner's liber Studiorum; and that those very impressions he (Mr. Ruskin) had given into the hands of engravers, that they might be copied, and rendered thus attainable to the general public. But he was, nevertheless, prepared to maintain briefly these points—first, that good art should not be cheap; secondly, that it, in one sense, could not be cheap; and thirdly, that if in any sense it could be cheap, that is accessible, they were not going the right way to make it so. First that it ought not to be cheap. The body required no change in its food; the soul did. That was one main difference between them. All who possessed any dear piece of art they liked, would feel that every time they looked at it they liked it better, because there was always in it something new—some new element for instruction. But if they saw continually elsewhere the same picture, they would soon be struck with a feeling of dislike for that which otherwise it would be their delight to look upon. Also, when art was too common it would fail to excite attention. The great enjoyment of art was when the whole mind was bent upon it. Great art ought to be accessible, but not to be multiplied in a way which would diminish the power of attention. Further, he believed great art *could* not be cheap. Some kinds of it could be so by being multiplied; and no person had greater sympathy than he had for those inventions which would enable copies of good works of art to be placed within the reach of the people. But let there be a careful discrimination between *multiplication* and *production*. Multiplication might be very ingenious and very useful, but we were not artists because we multiplied the works of others. And the highest art was more or less to be defined as the expression of a great human mind by the body that contains it—expression of brains through the *fingers*. In no way, therefore, could good art ever become cheap in production; we ought to desire only that when produced, it should be thoroughly accessible to all, and that the people, as far as they has the power of producing it themselves, should be assisted and encouraged to do so. The paper had seemed to dwell wholly upon the advantage of art to the consumer, or only to the producer as a mercantile matter. He was sorry it did not show the effect of the production of art upon the workman; surely the happiness of the workman was a thing which ought to be considered; and that brought him to the third point—the way in which so far as art might be cheap or accessible at all, it might be by what we did for our workers. He had some knowledge of what could be done by the workmen, and of what talent they possessed, and therefore he feared the tendency to depreciate this imitation of nature which ran through Mr. Wallis's paper; for all that he (Mr. Ruskin) had been able to do with any success was by directing the workmen expressly to nature. Mr. Ruskin fully accepted *two* of Mr Wallis's principles, namely that the *material* and the *use* of the object to be produced should be first consulted; he heartily wished that those two rules were accepted by all, and steadily adhered to, and that, in one branch of art especially—now coming daily more and more into practice—painting on glass, it were always remembered by the workman that the use of a window was to let in light; that the virtue of the glass in a window was to be transparent; and that all art which tried to represent it as opaque—as a picture, instead of a window, was mistaken and absurd. But accepting fully these two laws laid down by Mr. Wallis, and holding always that no art-production was right, unless first of all serviceable for its proper purpose, he pleaded beyond this, for the direction of the mind of the workman straight to nature, whenever he had to introduce ornament at all. All the true nobleness of art had come from people loving nature in some way or the other, expressing their sentiments about nature; and exactly in proportion as the reference to nature became more direct, the art became nobler. So, then, art was to be encouraged—not by multiplying productions of past times, but by educating the workmen of our own—and after having filled their minds with knowledge of natural objects, leaving them free to invent continually new forms of objects, and new applications of their knowledge. And by thus proceeding we should elevate our workmen, and make them happy; and the ends of commerce would, at least, be answered far more effectually by producing thoroughly new articles than by multiplying forms of old ones.

Mr. J. G. CRACE had heard with much interest and satisfaction the interesting paper read by Mr. Wallis, and he fully concurred in the opinions that gentleman had expressed on the principles that should govern designs for the various branches of manufacture. He could not, therefore, but dissent from much that had been expressed by the last speaker, who differed in many points from Mr. Wallis, and though he (Mr. Crace) admired his beauty of language and power of expression, yet his arguments seemed to be so weak, while the principles he (Mr. Crace) advocated were so strong, that they might not suffer even by his want of ability to give them due expression. Beginning with the remarks on textile fabrics, it was to carpets that Mr. Ruskin more particularly alluded. He said that what was beautiful in nature could not be out of place however exhibited, and he repudiated the system of flatness which Mr. Wallis considered so essential a quality of carpet design. Mr. Crace thought that Mr. Ruskin misunderstood the remarks of Mr. Wallis on flowers, which he did not altogether condemn, but said that they should be introduced with due discretion, and he certainly added that, admitting the flowers, it was not necessary that the flower basket should be represented too. If the floor on which we walked was a flat surface surely it should look so, our footsteps should not be puzzled by treading on projections in imitation of objects in relief; and besides, was it not an essential quality of design that it should be adapted to the nature of the material; the stitches, so to call them, of a carpet had a certain size, and it was not possible to imitate the shadows as accurately as by the brush, and he (Mr. Crace) maintained that the beauty of flowers on a carpet was increased by such breadth in the lights and shadows of the flowers, as would preserve that flatness so essential to the suitableness of a carpet design. Referring next to Ceramic manufacture, Mr. Ruskin asked how could Mr. Wallis condemn flowers in carpets and yet commend the skill displayed in an imitation of Palissy ware, in which objects of nature were imitated in relief? but this was surely a misapprehension; the suitability of the design was not the question, but the art displayed, gratification at finding men do such works now again in 1856 as Palissy executed four hundred years ago. Next we came to metal work, and on this subject it was that Mr. Ruskin expressed himself as so much opposed to cheap art, and strongly condemned the multiplication of a beautiful object. There were on the table some beautiful groups of figures, executed in silver, but from the nature of the work, and the material and the labour bestowed, they were far too costly to be in the hands but of very few. If, by any scientific process, the full beauty of the originals could be preserved, and the work of art could be enjoyed by thousands, surely you would not condemn that process. He did not understand Mr. Ruskin's opinions, for though he said it was revolting to the feelings of a possessor of a fine work of art to discover that the object he so loved was to be found repeated elsewhere, yet he told us that the gems he had collected he was having reproduced for public circulation. He could not condemn copies of beautiful paintings by engraving, or the casts in plaster of marble statues, such as the Venus de Medici, or the Apollo, and surely if by a modern invention we could have perfect imitations of beautiful works in metal, he would not oppose this. Paperhangings were, Mr. Crace thought, also remarked on, and an allusion made to the Camera de Correggio as showing that flowers and trellis-work and sportive children were introduced in wall and ceiling decoration by so great a man. No one could object to a work of genius so displayed, but he should most strongly object to a vile and vulgar imitation of it as a paper hanging. He would advocate the importance of designing papers suitable for the humble home of a poor man in a consistent and proper style; if cheap, let them at any rate be in good taste and in pleasing colouring, not attempting too much, and doing it well. He had intended to remark on other branches of our manufacture, especially on the more ordinary articles of household furniture, the makers of which often outraged the rules of good taste—more especially by the unnecessary size of the mouldings they used. He had seen an ogee moulding to the top of a wardrobe, large enough for the cornice of a house in King William-street, but the hour was now so late that he felt he ought no longer to trespass on their time. He should only add a remark that much was still in the power of the government towards educating the taste of the people, by bringing before their notice works of decorative art in our public buildings. In France, a minister was appointed for the supervision of public works, a man chosen for his cultivated taste in art, not for political influence, and who directed not only the decorations of public buildings, but ordered pictures and statues to illustrate the history of events; in fact, doing always, and in an extensive sense, what the Royal Commission, presided over by Prince Albert, was doing for the New Palace at Westminster. By these works a number of artists would be exercised in high branches of art; and, besides thus supplying a school for designers, the public taste would be elevated, and would be better able to appreciate what was good.

Mr. Redgrave, R.A., concurred with much that had been said by both the speakers that had preceded him. With regard to Mr. Ruskin's observation, that good art could not be cheap, he thought Mr. Ruskin was looking to fine art, and Mr. Crace to manufactured art. Fine art could not be cheap, but there was another sort of art, which was manufactured by machinery, which might be good and yet cheap. The one was imitative, and proceeded from the love of the artist to nature itself, the other was not necessarily imitative, but arose out of looking to nature and choosing from her all those beauties of form and colour that could be made applicable to a reproductive process. It was very desirable, therefore, that the workman should be induced to look at nature itself, from the study of which alone could novelty and beauty arise. With regard to what Mr. Crace had remarked about carpets, certainly, though we might introduce flowers into our carpets, we should not introduce the flower basket. Yet even that was a slight fault compared with what was oftentimes the case now, namely, that we saw pictures introduced rather than ornament. There had been something said about principles in art, but as we ought to be very modest in selecting what are principles, our only way was to try and collect, from the choice works of the best periods and masters, and the writings of those who had deeply studied them, a code of laws, or principles, as a standard to which we could refer. Mr. Wallis had asserted that there was an improvement in the general taste of art applied to manufacture; this was of course only the assertion of one individual, but if there were any code of laws and rules by which to judge this improvement, it became no longer a mere assertion; and we should never be able to decide whether there was really an advance or not until some such standard was established. They had arrived at one or two tests that evening, on which all seemed agreed, the test, namely, that utility was to be the first object to be considered; they then went on to the proper use of materials, and they thus obtained another true principle which could go towards arriving at some code of rules or some standard by which they could tell whether any advance in art as applied to manufactures had been made or not, and thirdly they had determined that there was a degree of subordination in the various objects ornamented by which we were to give to one more prominent decoration than to another. As these rules became established in men's minds, at least some criterion as to advance or retrogression would be arrived at, and he hoped this was advanced by the discussion that had taken place.

Mr. Varley said that the Chairman had reminded him of a former statement, when he used the word "cooking," which would apply to design as well as to anything else—namely, the necessity of some prior preparation to adapt nearly everything we use to our purpose. By cooking, much that could not be used was rendered usable, and all food was rendered more wholesome and more agreeable by it. Now the art of design was only a more perfect adaptation to our use of the articles we needed. On going to a new country we might find materials for everything, and yet be helpless till art came to our aid. There might be timber of value to the merchant, minerals and clay for tools and vessels, vegetables and animals for food, and yet he must use skill before he could shape and adapt these to serve his various wants; and as cooking destroyed all original and sometimes disagreeable identity, and reduced the materials into a new form, which was only needful and agreeable food, so the arts of construction and design removed from us all attention to the original state of the material, and gave us useful articles for our necessity, so clothed in beauty as to remove all ideas of their necessity, and instead stimulate our minds with joy and delight. Thus, all things were either cooked or clothed for our more comfortable use; and what was needed to guide and regulate design was order and due precedence. Mr. Wallis alluded to carpet designs. Some persons said that the pattern should indicate flatness, without any relief, as a surface to walk on, and that they should be subordinate to the furniture. Nature would decide that distinct relief was good, for the earth was clothed with grass and meadow flowers, on which we and animals freely walked. We only removed such bushes and branches as would obstruct our free progress, and we enjoyed the soft velvety tread and the silence of our steps. On a boarded floor, the noise of moving chairs, and of our steps, was often a nuisance; carpets cured it and added an agreeable softness to our tread. Having a carpet, its colour and its pattern became of consequence. But where great numbers were assembled there would be much confusion and obstruction if the laws of precedence did not decide who should move first, second, and third. This secured order and comfort; so, if the first personage, the architect, was to design the room suitable for the required furniture, and dictate the colour and design of that furniture, then the carpet design would come in third; if the furniture was massive and plain, a rich texture or pattern in the carpet would make that plainness agreeable; but if rich in carving and ornament, then a quiet pattern was needed to give the furniture precedence. In designing a carpet, the building, the furniture, and the sort of company should dictate its character, colour, and pattern. But now, for want of order, the architect could rarely assume his precedence, and the cabinetmaker did not respectfully follow his steps; so the carpet designer, being without his proper guide, made various designs, and left the public to match them according to their own notions. The liberal possessor of Newstead Abbey, Col. Wildman, had suited his furniture to the abbey, having richly carved cabinets with bible history in bold relief, the chairs and tables light and elegant, with many other accompaniments, to keep up a rich union of the whole, and with due reference to the poetic spirit planted there by Byron. Fitness and proportion are essential parts of beauty; and whatever design was made, it should be with reference to the place and other designs with which it was to be associated. Proportion was not sufficiently attended to in the union of sculpture and architecture. St. Paul's looked very grand from Blackfriars-bridge; but the figures on it, which ought to be its guage, were eleven feet high, and therefore kept contradicting the impression of size. As groups, the size was right, but the figures composing them ought to be life-size, as they were the only visible guage of its great size.

Mr. Ruskin wished to explain that he was anxious to lay before the public all good works of art, though not to such an extent as to allow them to become distasteful. He believed that if all men of dignity and standing in the arts were to meet and settle a few principles, and make them the goals of art in all schools of design, it would be of incalculable advantage. They had to fulfil the duty of imparting a true taste in design, not only to the producer, but also to the consumer, but this duty could never be properly performed until all were agreed upon some principles which should form a basis.

The Chairman having called upon Mr. Wallis to close the discussion by any remarks he might desire to make,

Mr. Wallis said, that he felt that the various points of the paper which had been touched upon had been fairly treated as a whole, but it was necessary to state that the subject was not art in its general and highest manifestation, but "art as applied to manufactures." This had been somewhat lost sight of. With reference to the carpet question, he thought that as Mr. Varley could not remember whether the room he had quoted had a carpet or not, but supposed that the floor was covered with one, that was the very best possible evidence to him (Mr. Wallis) that the carpet was not a very bad one in design, and did not assert itself very strongly in form or colour, and, therefore, was in its right place, or Mr. Varley would have remembered it. His own test of a tastefully decorated room was, that if on thinking about it after he had left it, no one object came prominently to his mind, there was not much the matter with it. He did not care to feel the sensation of having been within a twelfth cake turned outside inward, which was the only parallel he could give of the decorative effects of some rooms. With respect to Mr. Ruskin's remarks, he must thank that gentleman for a verbal criticism, since the term "multiplication" ought to have been used instead of that of "duplication." It was quite clear, too, that in great efforts in art, where the individual worker alone was employed, that the work should indeed be the expression of the whole man, but this scarcely applied to works of utility, produced as they must be in great numbers; not but that the more the spirit of the worker was infused into them the better they would be executed. With respect to the question of cheap art in its highest form, it could no more be obtained than cheap gold or cheap diamonds; but the question in hand was really that of the production of articles of manufacture into which art entered as an important element; and in this respect he (Mr. Wallis) maintained that the art might be materially cheapened, so as to bring it, more or less, within the means of all. Mr. Ruskin's charge of inconsistency in his (Mr. Wallis's) approval of the revival of Palissy ware, and condemnation of the ultra-naturalesque in ornament as applied to articles of utility, was unfortunately itself inconsistent, especially in the example Mr. Ruskin had quoted, since it happened that a "Palissy dish" was in reality no dish at all for use, but simply an ornament, the surface of which was so covered with imitations of animals and plants, that no room was left upon which to place anything else; in short, though an object of beauty, it was not one of utility, in the strict sense of the term, when applied to a manufactured article. Mr. Wallis approved of the revival of the manufacture of Palissy ware, because it would lead to truth of imitation, and thence to better things in ornament. His doctrine as a teacher had ever been imitation first, and then invention or design. He always urged this upon his students, and would allow no attempt at invention except as based upon accurate imitation. He fully sympathised with Mr. Ruskin in his anxiety that the workman should take an interest in his work. It had ever been his aim with his students to endeavour to project some portion, at least, of his own earnestness into them; for he did claim to be earnest in his work, be the results what they might; and few things had consoled him more during the fourteen years' experience he had had in schools of art, than seeing his students earnestly, and in all truthfulness, pursuing their daily career with a zest for their occupation. If this love of his work was once infused into a man, much had been done towards laying the foundation for his future progress; and the more a workman understood the "why and wherefore" of that work, the greater the interest he would take in it. Hence the value of sound instruction, line upon line, form upon form, principle upon principle, even to the end. His subject had been "improvement in design," but he could have wished to have said much about improvement in handicraft power, for he believed that much had been effected in this direction, and that one of the difficulties which used formerly to beset any effort after a better style of art—the lack of working power to execute it intelligently, was fast being overcome. This was an important point, since to make designers without workmen was useless, whilst a few designers in each department of industry would be sufficient for the employment of a large number of workmen; thus the great object of all instruction in art, as applied to manufacture, would be accomplished, the brain power being sure of realisation by educated hand power.

A vote of thanks having been passed to Mr. Wallis on the motion of the Chairman, The SECRETARY stated that the paper to be read at the meeting of Wednesday next, the 19th inst., was "On the Principles Regulating the Transfer of Useful Plants of one Country to Another," by Mr. Maxwell T. Masters. On this evening Dr. Forbes Royle, F.R.S., will preside.

The following are the letters referred to by the Secretary:—

Mr. W. C. AITKEN (of Birmingham) says:—

"I exceedingly regret that I cannot be present at your meeting to morrow evening, to take part in the discussion which will doubtless follow the reading of Mr. Wallis's paper on "Recent Progress in Design as applied to Manufactures," the proof of which you have kindly sent me for perusal. In his remarks, as to taking advantage of the recent discoveries made in modern science and in their application to manufactures, I entirely concur, as also in those which refer to the effect which the labours of the late A. W. Pugin exercised on all the subjects which he touched, but more particularly in his placing prominently before the public and manufacturers, the principle that fitness for the purpose, in connection with suitable ornamentation, should ever be kept in view, and that the latter should ever be kept subservient to the former. These views I adopted and propounded at length in a paper read by me before your Society, "On Ancient and Modern Metal Working," on the evening of the 15th of February, 1854, and which will be found in page 229, Vol. II. of the Society's *Journal*, to which I respectfully refer the members. The causes which have operated in producing those improvements in design to which Mr. Wallis alludes, are somewhat numerous; we have at work, in addition to our Schools of Art, our illustrated periodicals and books on ornament; in the van of these we have the *Art Journal*. the works of M. Digby Wyatt, of Owen Jones, and the impetus given by the various Exhibitions of manufactures in connection with your Society; the Birmingham Exhibition of 1849, the Universal Exhibition of 1851, and the French Exhibition of 1855. These Exhibitions, by disclosing at a glance the true state of art manufactures, and affording the means of comparison, insensibly forced the good on the mind when contrasted with the bad, and the eye and taste became educated thereby; the result has been that the general public has been educated in art; and the articles distinguished formerly by crude, imperfect, and inappropriate ornament are now comparatively seldom asked for, at least not by those of the middle and upper classes, who have been enabled by these means to examine for themselves collective assemblages of art industry. As to the means by which the want of a superior class of articles has been supplied to meet the better taste alluded to, it cannot be denied (however humiliating it may be for us to acknowledge it) that we have received very great assistance, not only from French designs, but from the actual employment of French draughtsmen, modellers, and chasers, &c., in our large manufactories. If the necessary talent could not be had at home, we could afford to import it from other countries, and we have done so. In doing so, however, we have only followed the steps taken by the French Kings and Emperors, who invited to their courts all the great artists of their periods whose works of art and practical knowledge of processes was likely to operate in raising art, fine and manufacturing, and encouraging an appreciation of it among the people. The influence of such a course is still apparent, and the quiet surface of the *renaissance* period is that which is now operating most forcibly among ourselves; the result is that large projections in ornament, interfering with outline and contour, are now but seldom recognised and employed by our leading houses, and this has insensibly introduced a style of design better suited to a refined taste.

"I differ from Mr. Wallis in his remarks as to the glass trade, and think the want of purity of material has its rise in competition, not in neglect; the absence of purity is not the result of indifference, or want of knowledge as to the component materials of which glass is formed. The cost at which glass articles for ordinary sale must be produced necessitates the employment of cheap alkalies, and the use of sand without its being entirely freed from the metallic oxides with which it is frequently impregnated; metallic oxides are employed to colour glass; their presence in a minute degree operates identically in the same way to the advantage of purity in the flint variety.

"Among the most crystalline glass ever made in this country, was that produced by Messrs. Richardson, of Stourbridge. Its purity arose from a thorough cleansing of iron particles by means of magnets. The other impurities were got rid of by careful examination and washing. During the preparations for the display in the Exhibition of 1851, considerable attention was paid to the manufacture of the coloured ornamental examples, and with the best results; Bohemia and Venice were all but rivalled. Since the Exhibition, however, the demand for articles of this class has not been great, and as much attention has not been given to the subject as it deserves. The support of large objects in glass, by means of internal metal rods plated on their external parts, opened a new field for the employment of design in glass. This improvement is largely due to the Messrs. Osler, of this town, and has been taken advantage of by them. The pressed glass process, alluded to by Mr. Wallis, has afforded the means of cheap production so far as ornament is concerned; the construction of the moulds, however, limits the contour, and somewhat circumscribes the field for design. The best examples produced have been those of a simple character in their ornamentation. Where least has been attempted the objects produced have been the most successful. With no desire to hark back, it would be well were our glass-workers to depend more upon simple contour, arising from manipulation in blowing and engraving, than upon cutting, to give value to their works. In this it would be well did they take a hint from the old Venetians, magnificent examples of whose works have recently been most judiciously added to the Marlborough House museum, and are well figured in the illustrated catalogue sold there.

"In metal manufactures, more particularly in those of the precious metals, Mr. Wallis has wisely adopted the intelligent opinion of Mr. Redgrave, expressed in his paper "On Design," appended to the Report of the Juries of the Exhibition of 1851. Art, rather than bullion value, is the thing to be desired in works executed in the precious metals. The 'dig' at the Naturalist School of Ornament is a fair one, but whence its origin? Simply in the want of a knowledge of design, and the desire to avoid mental labour, conjoined with an ignorance of conventional treatment. As familiarity with design becomes more general, such productions will be less frequently seen; even now it is evident that the style has reached, and is even now in, its decadence. Allusion is made to the influence exercised, or supposed to have been exercised, by the French Exhibition of 1844. On the metal trades a far greater influence, however, was at work, viz., the importation of French window cornices and other stamped work. Competition became a necessity on the part of the English manufacturer. It was, therefore, natural that something akin to works which sold so readily must be tried as a substitute. Without intelligence to guide them is it to be wondered at that in their attempt to out-Herod Herod things of a similar kind were produced. Now, however, the French are at a stand-still, and produce stamped brass-work of as florid a character as ever, even reproducing, because they sell a class of articles formed by a union of glass and stamped brass, examples of which were honoured with a place in the now defunct "Chamber of Horrors." The same walk has been essayed by the German manufacturers of stamped goods, who have copied even our errors, and displayed them on their stalls at Paris in the Exhibition. In this particular department we have turned the corner, and left behind some of our extravagances. When stamped cornices are now made, the ornamentation, if not all that could be desired, is, at all events, of a quieter and more unobtrusive character.

"In gas-fittings and chandeliers it will be found on examination—always keeping in view that those examined have been recently produced, and by respectable manufacturers—that there is in them a change for the better, that they are not of the 'gooseberry-bush turned upside down' class, and that there is visible in them a greater attention to non-interference with the diffusion of the light, arising out of a more graceful and elegant style of construction and ornamentation being adopted. Were, however, the facilities for education in modelling to be somewhat more extended and as free as in France, and were it cultivated to the same extent as it was shown to be in that country by Mr. Redgrave in his late speech at Birmingham, who could doubt but that even a greater improvement than there has been would be speedily apparent.

"I could have wished that in the remarks of Mr. Wallis on jewellery, he had alluded to the influence which French jewellery has exercised upon our own, and to the very splendid display which occupied a large portion of the gallery in the Paris Exhibition, leaving out of the question altogether the works of Froment Meurice and Rudolphi, which, from their great cost, places them beyond the reach of even the middle classes. Some allusion to French jewellery, in connection with the works of our jewellers, would have been very useful, and all the more so had he stated how varied were the forms, how original; and as to the liberal use which had been made of the enamel process in their ornamentation, the introduction of colours more numerous and difficult to produce than it is customary or possible for our jewellers to employ, at least up to the present time they have not done so. The reaction in favour of Birmingham goods had its origin in the local exhibition of the town, and the addition to the exhibits shown in the Exhibition of 1851 of the manufacturers' names. Mr. Wallis does not appear to have alluded to the effect produced by the new method of casting zinc in iron moulds, and thereafter bronzing them, as a source from which art objects, or things for use of an ornamental character could be produced at a cheap rate, or rather have been; and how much such has operated, and is likely to operate, in improving the character of our works in metal. I could have wished he had done so. How well they are suited for this purpose, every one who has examined the works of the Vieille Montange Company must have felt convinced.

"There are other topics upon which I might have dilated, important in themselves, as elements in the still further improvement in design as applied to our manufactures of a superior, or even of a commoner class, but my time and your space preclude the possibility of my doing so. The causes which have led to the improvements, and to which Mr. Wallis has alluded, should not, I consider, be overlooked; and of these I have enumerated a few. With the general tenor of Mr. Wallis's paper I agree, with the exceptions stated.

"I earnestly desire that the improvement in design as applied to our manufactures may progress in the same proportion as it has done during the past ten years; and, in order to assist in this desirable end, that our schools of art may be increased in efficiency by their means of support being quadrupled; that illustrated works treating upon ornament, such as the industrial arts of the nineteenth century; Wyatt's metal work; the Grammar of Ornament of Owen Jones (now in progress of being published) should be more universally circulated than they have been; and last, but by no means least, that museums or collective assemblages of objects akin to, and suggestive of, improvement in the special manufactures of our great centres of industry, should be instituted for the art education of the artizans employed therein; these are the means to an end, which all interested in our national progress must earnestly desire to see arrived at."

M. Louis Arnoux (of Stoke-upon-Trent) says:—

"Messrs. Hollins and Campbell have sent me the proof of Mr. Wallis's paper, "Recent Progress in Design as applied to Manufactures," and although I agree with him in most of his views, yet there is a point or two on which I differ, chiefly as to the cause of the recent improvements in our Fictile Manufactures. Certainly there has been a general demand for better articles than those previously brought out; but as far as I can judge, during the seven years I have been residing in the Potteries, it is due more to the good taste and artistic talent of Mr. Minton, and his knowledge of the best way of improving all branches of his manufacture, than to any other cause. The competition, too, which existed for many years between his firm and that of Messrs. Copeland, could not fail to produce an excellent effect. According to my judgment the greatest improvement has been effected in the modelling department; and if Mr. Wallis will refer to the late Exhibition, he must admit than Mr. Minton's models, chiefly for Parian and Majolica, would rank in every respect with those of Sèvres, and were far superior to those of any other exhibitor. The same improvement in the painting cannot be affirmed, though a decided progress is taking place.

"I think that Mr. Wallis does not dwell sufficiently on our Majolica and Palissy ware (commonly so-called), and he ought to mention Mr. Minton's name as being the only party using exertions to revive this class of goods. In fact, from the combination of his processes, and the variety of coloured glazes and enamels he uses, Mr. Minton has borrowed as much from the enamellers as from the old pattern of the *renaissance*. If Mr. Wallis remembers what has been produced by the eastern enamellers (Chinese, Arabian, and Byzantine), and that most of the effects they have produced may be repeated now in pottery, he will see what a broad field has been opened for future improvements. Certainly this manufacture has not yet reached perfection, but what is done now has not been done so well since the sixteenth century; and probably further practice will bring us to a higher point. Mr. Wallis knows, at all events, what a difficult problem to solve is the colouring of high relief; and I think that he ought to insist on the introduction of this manufacture, as evincing the most striking progress in the way of accomplishing it.

"Without wishing to despise the inlaid Parian of Messrs. Rickuss and Toft, I may remind Mr. Wallis that it is nothing more than what Mr. Minton has been doing for many years past in his manufacture of encaustic tiles. It was also done previously by Mr. Spode, who made a great many garden-pots in this description of inlaid body. It is nothing but the process first brought into practice by the clever potter who made the 'Henry the Second ware.' As to Messrs. Pratt and Wedgewood's process of enamelling on a red or brown body, they have followed the good examples which were sent to this country years ago from China and India."

Mr. John Bragg (of Birmingham) says:—

"In reply to your invitation I beg to remark, that having taken a deep interest for many years in the improvement of art manufactures, and more especially in that one (jewellery) to a branch of which I devote my attention, I have no hesitation in confirming all that Mr. Wallis states in respect to the improvement which has taken place during the last few years in the style of Birmingham-made jewellery. There has unquestionably been a most remarkable impetus given to the trade, as a manufacture, since 1850, and it is considered by competent authorities that including gold, gold plated, and silver jewellery, with their dependent trades of lapidaries, engravers, enamellers, chasers, &c., there cannot be fewer than five thousand persons employed, entirely and directly, in these branches of the jewellery trade in Birmingham at the present time. Besides these, we might name the 'gilt toy' trade, which seems to be reviving with a new and superior style of articles. That this increase is wholly due to the improved designs produced is not for a moment pretended, but I state, as the opinion of many with whom I have conversed from time to time on the subject, and most decidedly as a matured opinion of my own, that in a large measure the above prosperity is the result of the generally more elevated taste shown in the articles manufactured.

"Perhaps, also, some share of credit may be given to the circumstance, that in Birmingham we pay great attention to the economics of production, so that an article which in Paris would cost wholesale, say 20s. sterling, and in London would be made for about 17s., would be produced in an equal quality of gold, and a finish almost equal (for in large quantities the finish always suffers a little), for about 14s. This great reduction is effected solely by bringing to bear every possible appliance of mechanical skill throughout every process and stage of the production.

"Still, together with this large wholesale production, we have made great advances in true style, and, I believe, can successfully compete now (on merits alone) with the whole world in all those departments of jewellery which are intended for the use of the middle class of purchasers. We do not pretend to the supply of those exceedingly costly suites and articles which can only find purchasers in the highest ranks of society. That will ever be a trade supported by the court and nobility, and of course will remain in the metropolis. We aim at a neat style and good quality, but at the same time a low price; and the success of the aim is best testified by the prosperity of the trade.

"That the largest part of the jewellery made in this town is sold as London-made, we are absolutely certain; and, indeed, we have almost resigned ourselves (as a body) to this fiction of the 'middle men,' for the shopkeepers are not so much 'sinning' as 'sinned against' in this particular.

"If I were asked to what I attribute this advance in our trade taste, and also in the public taste at the same time, I would say that the public schools of art, the national and provincial exhibitions of art, the wide diffusion (by cheap processes) of fine examples of manufactured artistic goods, and the numerous art publications, critical and illustrative, have been the means of educing the improvement.

"And if I might presume to suggest what would more than anything else now forward the movement, both among manufacturers and the public, as consumers, I would say, 'A book (got out by the Government, if you please, or, perhaps better, by private speculation) in which shall be laid down, in an orderly, progressive, and therefore simple manner, the principles of decorative art, both as to form and surface decoration; and this to be issued in several editions, or rather varieties—viz., one with illustrations and principles bearing upon textile, another upon fictile, another upon metallic productions, &c. —so that a Birmingham student need not purchase all that relates to Manchester or Macclesfield goods, nor the Potteries be compelled to have treatises upon ribbons and jewellery. The one general essay would be the same in all, but the supplemental part would be different in each."

Mr. Young Mitchell (cf the School of Art, Sheffield) says that he agrees "cordially with the views expressed by Mr. Wallis. Any one who has given attention to the subject must allow that the Schools of Art have effected much good, but their great work still remains to be done. They have to educate the public, to give a knowledge of what is true in art, and thus create a demand for the beautiful. This done the manufacturer will supply, as a matter of course."

Mr. James Houldsworth (of Manchester) says:—

"I feel obliged by yours of the 8th, and regret that it will not be possible for me to attend your meeting on Wednesday. The perusal of Mr. Wallis's paper has given me much pleasure. I look upon it as a valuable record and statement of principles. It is to be regretted that there is not a more general progress to report, though Mr. Wallis has evidently endeavoured to make the most of whatever favourable indications he has seen. My own observation of several branches of trade is confirmatory of his own, and in one only do I entertain a different impression, viz., furniture and cabinet-work. The beautiful specimens I have seen in many first-class cabinetmakers, leads me to think that many of these productions would compare favourably with those of continental manufacture, while it has also struck me that the style of furniture generally has improved, and that better taste prevails in the large manufacturing houses.

"The principles expressed by Mr. Wallis have my hearty concurrence, and in nothing more than in the stress he lays on the position of the middleman in influencing public taste. The retail dealer stands between the manufacturer and the public, and can effectually discourage the one and deprave the other. In complaining, however, that too many of them will not make or keep anything except what they consider good to sell, I am sure Mr. Wallis does not mean that men of business would knowingly make or keep what they consider will not sell! He hints in another place that it is just possible that the taste of the dealer himself may improve. Now, I think, that on this consideration alone can we look for his placing before the public a higher class of goods to choose from. The selection that is made by the public constitutes the taste of the day, and while its character must in the first instance depend on what is offered for selection, approbation will only be due in proportion to the ability of the purchaser to appreciate the best and reject the worst. Our national characteristics, and still less our national education, are not favourable to the cultivation of this discrimination; and though efforts are now making, vulgarity requires time as well as refining influences to diminish its intensity, and generations must grow up under more favourable circumstances for becoming familiar with works of art and good taste, before the public, as a body, will demand a higher class of productions. It becomes then the duty of the retail dealer to guide the public taste. To do this, he must first educate himself, and he will soon find that his knowledge gives him a power over his customer. Successful salesmen of fancy goods vary from others more in their superior information than in any other point. Knowledge of styles and precedents, historical reminiscences, appropriateness of combinations, effect of colours and lights, comparative costs and experience of wear, &c., command an influence over a customer that polished manners, coincident tendencies, and deferential suggestions respecting the beauty of everything exhibited fails to inspire. The best salesmen generally say they can sell anything they like themselves; and I look upon the education of these men as the quickest and most economical way of influencing public taste. Manufacturers may require it as much as they do, and the public even more, but the manufacturer is compelled to keep up to the quality of demand, and stimulus applied to the purchaser acts directly on the former. The education of the public, again, is a larger scheme, and can only be done slowly and indirectly by such means as museums, exhibitions, street architecture, shop windows, &c., and while this should go on and will in time bear fruit, the improvement of those who buy and sell will produce the earliest effect upon the trade of this country.

"I will only add, that I am particularly pleased with the enlightened views which Mr. Wallis expresses on those mechanical, chemical, and other means which every day is adding to our knowledge, and for his repudiation of the idea that art and beauty are to be advanced by ignoring their existence. There are difficulties enough in this world without creating them, and every one is bound to do the best he can with all the means at his disposal. Should the facilities for reproducing and cheapening works of art or beauty interfere with predilections in favour of uniqueness and exclusiveness, theirs must indeed be a selfish pride and false admiration who see inconsistency and want of taste in the free employment of all God's gifts."

Mr. GEORGE JACKSON (of Manchester) says:—"I very much regret that I shall not be able to avail myself of the kind invitation with which you have honoured me, to attend the reading of Mr. Wallis's paper, on Wednesday evening next. From lengthened intercourse and associated labours, I doubt not that the views he will take of the subject will fully coincide with my own experience and convictions, and I should have been happy of an opportunity of supporting them in the course of the discussion after the paper.

"It may be some support, and illustrate the progress art is making in public estimation, if I relate the result of my observations on passed events since I came to reside here, in the year 1833, confining my remarks more particularly to the building, furnishing, and decorative trades, with which I am more intimately connected. At that period no means of elevating taste or informing the minds of the people on artistic subjects existed. The annual exhibition of the works of modern masters, in the Royal Institution, was the only public display, but the terms of admission were too high, and the hours in the day forbad the great mass of society from seeing it. The staple products of the district had called into existence a certain class of artists, or rather what are technically called designers, whose pursuits led to no beneficial results beyond the manufacture they laboured for. The conventionalities of their style, not being based on the true principles of art, tended rather to depress originality of thought. A large amount of intelligence and persevering inquiry existed; natural history, botany, and music, were cultivated to a state of perfection which rendered the Manchester naturalists and Lancashire choral singers celebrated.

"In my early intercourse with large numbers of the working classes, I was much surprised to find a body of men, who so well understood the theories of the abstract sciences, so little acquainted with the principles of art, or who held such false views of what constituted the beautiful. The wealthy manufacturers and merchants were great patrons of art, and collections of some of the finest works were to be found in this district, but confined exclusively to old masters; modern practitioners had, then, little chance of their support.

"The general habits of the people were of a very low standard; and, in the absence of any public place of resort or general rendezvous, no inducement existed to refine their personal habits or develop the moral feelings. Such was the condition of this district until after the issuing of the Report of the Committee of the House of Commons on Arts and Manufactures, in 1836. The publication of that Blue Book speedily aroused attention, and the intelligence of the people was directed to the importance of those departments of art which they had so long neglected. Many thinking minds endeavoured to devise the best method of following up the valuable suggestions the report contained. It was, indeed, the true Magna Charta of the industrial arts, and more or less, as circumstances have permitted, has it been the rule of action and code of laws in all artistic educational movements here. The Mechanics' Institutions were the first to take up the question, the directors being desirous to ascertain the best means of improving their system of instruction in their drawing classes.

"The discussion attracted public attention, and the necessity of a school for disseminating knowledge of the elementary principles of art became manifest, and brought about the establishment of a School of Design. From intimate connection with these movements, I had a good opportunity of ascertaining public feeling amongst all classes of the community, and found it to result, in what might have been expected from such an extended diffusion of scientific knowledge, in the general desire to promote any means that could be offered, or were intended to accomplish what was found to be a desirable end.

"The directors of that institution, seeing the general ignorance that pervaded society of the nature and importance of industrial art, resolved on holding an exhibition of a polytechnic character, which was opened in the winter of 1837-8. The result exceeded the most sanguine expectations. It was open five weeks; the admission fee 6d.; the receipts £1,078; which gives 43,120 visitors, upwards of 8,600 sixpences per week; and it must be borne in mind that, owing to the nature of the avocations of the people, the bulk of this money was received during the evening.

"To the effects produced by this exhibition I attribute much of the progress which has since manifested itself in appreciation of art in this district. It gave an impetus to public attention, and its success led to its imitation in many other parts of the kingdom. To the silent instruction which these exhibitions have administered through the eye, we may attribute the origin of the improvements in taste and desire of knowledge of art that exists at the present day.

"Early in the year 1838, the convictions which the report of 1836 had produced, strengthened by the results of the exhibition, developed the desire of the mass for increased facilities for obtaining knowledge of the principles and practice of art; the School of Design was founded, and, though the sanguine expectations of benefit to be derived from it were not realised, the fault or failure did not arise from the want of support or appreciation of its necessity on the part of the people, but from want of information amongst its conductors as to what ought to be its real object, and how instruction should be imparted.

"The desire which demand has created for increased facility of executing amongst ourselves works of an advanced stage of industrial art began to manifest itself. Facility of intercourse with the Continent induced many of our leading manufacturers and overlookers of works to visit the Exhibition at Paris, in 1844, and most of them returned with a settled conviction of the necessity of urging forward by their influence and means all suggestions that tended to promote the intelligence of the people and inculcate a love of art.

"The School of Design had been remodelled, and was conducted on a system which embodied a class of instruction sought by the industrial classes as being more immediately applicable to their general avocations. A movement at this time was made to establish public parks, the opening of which produced a radical change in the manners and habits of the people; the necessity of cleanliness and a better adornment of the person soon produced its effects; shortening the hours of labour, and the almost universal adoption of the Saturday half-holiday, created a want the parks were well adapted to fulfil. Order and decorum took the place of rude and listless conduct, and induced a habit of thinking, which has resulted in the moral elevation of a large mass of our operative population.

"The success that attended the opening of the parks induced the Salford authorities to open a Museum of Art, &c., in connection with the Peel Park, the statistics of which, to the present time, have been highly satisfactory. The last report of the Council gave the following result as to the number of visitors frequenting it:—

November, 1855	27,000 persons.
December „	26,000
January, 1856	28,000

Donations are continually flowing in, and the building, which has been recently considerably enlarged, is fast becoming too small to afford space for the proper exposition of the specimens of art, &c., they now possess. The success of the Free Library in Salford, induced Sir John Potter, then Mayor of Manchester, to take up the question, and he resolutely resolved to solve the problem whether the taste and intelligence of the people were sufficiently advanced to appreciate the privilege of being allowed to read good and standard works on art and literature at their own homes. The proposition to establish the Manchester Free Lending Library met with that energetic support which speedily carried it into effect, and last year, the third of its existence, there were issued—

	Volumes.
To readers in Reference Department ...	66,261
To borrowers in the Lending ditto	81,321

I feel that these statements may appear to be a digression from the main subject; they are inserted with a view to demonstrate the importance of cultivating the habit of refinement of conduct, and the power that these silent instructors, whose influence only affects the eye, exercise in the cultivation of all those feelings of the mind which invariably result in the refinement of taste.

"About the year 1846-7, the Council of the Royal Institution were induced to open the galleries containing the Annual Exhibition of Paintings at an admission fee of twopence, from six until ten o'clock, during the evenings of the last month, or five weeks of its continuance. The amount received exceeded the total receipts of the shilling day admission considerably.

"Such was the state of industrial art about this period; very little facility existed for executing any works without extraneous aid. In the building trades, anything that went beyond the plainest style of moulding or form had to be executed elsewhere, and worked into the construction here. It is not a long time since there was not a stone-carver resident amongst us. Interior ornaments were of a very hackneyed and universally known class, and the execution not above the style. In glass staining we had no one who produced any work much above a plain colour; and the iron and metal works did not extend beyond the casting of a shaft for a steam engine, or the fly-wheel to regulate it. I am happy to say these days are passed, and that in many departments of decorative art we now rank second to no provincial town.

"A great impetus has been given to the building trades by the spirit and enterprise of our merchants and manufacturers, in their desire to make their emporiums of trade carry the appearance and bespeak the magnitude of their transactions. No less fortunate that the demand has produced the men, and we have architects now resident whose labours have resulted in the proof that our street architecture is fast approaching that degree of elegance, originality of conception, and purity of style, of which we may be proud as citizens, and offer an example to other wealthy communities to follow in our path. These remarks are alike applicable to the manner in which the works are executed and to originality of design.

"In the class of trades connected with internal decoration, our strides in improvement have been as great, excepting extraneous addenda. I think we have a class of artizans amongst us now equal to the production of the finest works; and employers, from the intelligence that has been brought to bear upon them, in their general arrangements of harmony of colour and beauty of form, execute works not excelled in the metropolis or elsewhere. The facility for accomplishing this end is mainly owing to the class of talented artisans who, attracted by the rising demand, have migrated hither, and filled the void of general talent so seriously felt in the early time of my residence here.

"For heavy machinery, you are aware, this district is celebrated; and it is a pleasing proof of the power of art that our greatest engineers find that beauty of form economises material and saves labour. Not long since, I was passing with Mr. Whitworth through his works, when he directed my attention to the curves he used, and told me his experience. There stood ponderous machines, without any extraneous ornament or addenda, beautiful in their simplicity, and their utility increased by their beauty.

"In glass manufacture we have made considerable advance, and in some branches of the ornamental character we have houses whose names stand high. A considerable quantity of paper hangings, both machine and block, are now produced here; and in metal work great advances have been made.

"I may further add, that these remarks I have principally written of Manchester; the same will apply with equal force to the out-towns in this district. I am not aware of one in which a marked improvement in industrial art is not visible.

"A fortnight since, at the request of the directors of the Mechanics' Institution, I delivered two lectures on the "Alphabet of Art, and Language and Power of Form," at Lancaster. The admission was free. I had large and very attentive audiences, of all classes of society, from the clergyman and town councillor to the mason and militia man, and, I hope, forwarded the object the directors have in view—to establish a school of art in connection with their Institution.

"When I look back only a few years, and recollect how little this question was understood amongst our large and intelligent communities, it is a cheering prospect to find its influences extending to such communities as this.

"I might allude to the effect produced here by the Great Exhibition of 1851. Suffice it to say that its influences have not yet died away, but will descend to a future generation. It was visited by a large mass of the people, and is, and will long remain, a pleasing theme of conversation.

"If, without infringing your rules on these occasions, I may be allowed to trace out what I conceive to be the requirements for the future, it would be to suggest that a mistake still attaches to all our efforts; that we are endeavouring to carry our system of instruction to a point that wearies the great mass of industrial artisans; they do not desire to become expert draughtsmen or beautiful manipulators,—they seek to gain a knowledge of the principles which govern the combinations of lines which produce certain and definite results. denominated styles. This might be done with less sacrifice of time and labour to themselves, and render them more efficient aids in the progress and development of art. It is the alphabet they seek first to learn, and then its grammar and syntax of form. These principles would enable them to mould the clay, shape the wood, or chase the metal, with intelligence, independent of the accurate manipulation required to perfect the character and maintain the position of the professed industrial artists.

"I have endeavoured hastily to give you the result of my experience in support of the paper to be read. I think there exists an extended spirit of inquiry in the public mind, which seeks and avails itself of every opportunity of satisfying the desire to become acquainted with the principles and applications of the theory of art, which, if fostered by extended means of information, will speedily remove the complaint of neglect of art which is now associated with the national character—at least it is so in this district. If these views should meet the concurrence of your Society, and lead to the discussion of the important question of future progress and development of the national and social importance of industrial art, I shall be glad."

Mr. JOHN LEIGHTON (F.S.A.) says:—

"I am sorry that I cannot attend to hear Mr. Wallis's remarks upon the "Progress of Design," but can, for all that, bear testimony to the general soundness of his views in reporting upon the American Exhibition, and his valuable notes upon the French Exposition of 1855, its virtues and its vices, for none know either better than the head-master of the important Art School at Birmingham.

"To instil great art into little things is what we want in England, to rear an army of educated workers from the highest to the lowest, and a public to encourage and appreciate the beautiful and true at sight; a commonwealth of art complete in all its branches, in which every one should aspire to be the first of *his* class rather than *of the* first class; how much greater is a Cellini with the powers of an Angelo than a would-be Angelo without the power to be even Cellini's drudge. Here small men in art aspire to great things, whilst the great ones eschew many things little, for fear of being thought small, forgetting that to great minds nothing is little. There is a great want of art in small things; go where you will about our metropolis and see how much pains are taken to render beautiful things ugly, and all for the want of a firm base—a broad base—art education upon sound principles disseminated amongst the people; once educate thoroughly the people to appreciate harmony of colour and purity of form, and it will become a part of their nature, and remain to after generations as if by instinct.

"How great an evidence of this have we in the display in the shop windows of Paris—where many of the dressers of the shop windows not only educate their fellow tradesmen but also the public,—a thing said by many to arise from an innate physical aptitude to appreciate the subtleties of art—a thing that I deny; it may have been the growth of years to instil, but once imbibed it becomes a part of the national character. I remember an instance of this in the French Exhibition, where many British goods, fine in themselves, were rendered repulsive for the want of tasteful arrangement; it was in the case of the representative of one of our great hives of industry, who could not for the life of him get his goods into harmonious order until the close of the Exposition; whilst his neighbour, with the same materials and an intelligent French agent, had his show one harmonious whole from the first day. What is the moral? Why, had this representative of one of our great manufacturing towns but devoted one day in his youth to study a few facts connected with the laws of colouring, it would not have deserted him in his need. Our painters are colourists, but they have not learned it from the people. Abroad the people have a lively appreciation of colour, that cannot be learned from their painters."

Mr. JOSEPH LOCKETT, of Strangeways Engraving Works, Manchester, says:—

"I am obliged for the opportunity of perusing the paper of Mr. Wallis on "Recent Progress in Design, as applied to Manufactures," and avail myself of your permission to offer a few remarks upon it. Being largely engaged in the engraving of designs for muslin, calico, de laine, &c., printing more than four thousand designs passing through our hands annually—representing the taste, or rather the character, of the productions of the principal houses engaged in the print trade of this country, and of the continent of Europe, the result of my observations may probably not be uninteresting, and are quite at your service.

"Mr. Wallis has stated, and correctly, that the will and taste of the manufacturer exercises, in many instances, very little influence over the production of the designs on which he operates, and that he is guided simply by the demand. This is still more correct as regards the foreign trade. The merchant receives instructions from his correspondent to procure certain classes and styles of goods for markets where, probably, the notions of beauty differ widely from our own; and the order is frequently accompanied by a rude and almost impracticable drawing, made by a 'native' artist, which the manufacturer has to adapt in such manner as to retain, as far as possible, the features of the original. In fact, every market of the world demands a special variety. These facts may serve to point out the origin and history of the 'ugly' patterns referred to by Mr. Wallis, on which the artizan is sometimes required to operate unwillingly, and consequently not with his wonted skill. As regards the production of designs for the home trade, we must look at home for the responsibility of producing such as are offensive to artistic taste; but here again the manufacturer is not the only one in fault. The wholesale purchaser, believing that he knows best 'what will sell,' in many instances employs his own designer, or selects, or 'gets up,' his own patterns, which the printer willingly produces, provided the quantity ordered and the price meet his wishes, in which case no pattern is ever regarded by him as 'ugly.'

"It is quite true that a great many patterns appear to be composed, as Mr. Wallis states, of 'shreds and patches, heterogeneously hurled together;' but on closer examination he would probably discover that the materials are methodically arranged for a distinct purpose, and with the view to produce a certain characteristic effect. Although such patterns are strictly artistic, yet unless the disposition of the colours and of the details be judiciously made, and the general result be suitable for the purpose desired, the pattern would be unsuccessful. It often occurs that an artist is very successful in combining patterns from materials presented to him, but who cannot originate; yet he must not be denied his fair share of merit. It is a distinct talent, and is frequently available for purposes which those who have higher talents could not perform as well.

"The demand for printed fabrics may be divided into two classes—one, where cheapness and utility are the principal desideratum. If the material be good and durable, and the pattern cover the cloth suitably; if it will not easily 'show dirt,' and the colours 'will wash,' the design is often, in reality, of minor importance; in which case the manufacturer frequently avails himself of 'mixtures and patterns from old pattern-books,' in which he is fully justified, inasmuch as he is enabled thereby to produce cheaply. Where the consumer of more refined taste has to be satisfied, a wider range for the talents of the designer is presented, and then the deficiency of the English artist becomes apparent. I am ready to admit that English designers have made considerable progress; but the French designers have also advanced, and the distance betwixt them is not diminished, and the greater part of the better class of designs 'brought out' by English manufacturers are of their production. The English designers belong to a less educated and less refined class than the French, who are carefully trained, in the first place, to the art of drawing, which acquirement they are afterwards taught to apply practically to the art of designing for industrial purposes, in the ateliers of skilful artists, and out of them they have the advantages of being surrounded continually by objects of elegance and refinement. The art of designing in France is looked upon as one which entitles the artist to a respectable position in society, and is correspondingly remunerated; hence a better educated class of youths is brought up to it than in England, where the art is not looked upon as of so much importance. Unless these conditions could be changed, the English designer is not likely to supersede the necessity of employing French talent where elegance and refined taste have to be catered for. An improved taste amongst the better class of consumers has already created an increased demand for superior productions, and the manufacturers find means to supply it; in the meantime, they will go on perpetrating artistic absurdities in design, so long as the majority of consumers, at home and abroad, do not appreciate and demand better.

"That the taste of the consumer may be influenced and elevated by familiarising him with a higher class of productions, is evidenced by the fact, that the calico printer was, in former times, compelled to produce distinct varieties of patterns for almost every country. Even Ireland had her own notions of beauty gratified by designs specially made for her. America required a distinct variety. Germany demanded a class of pattern totally different to either. At the present day, taste is so extensively assimilated to that of Paris and London, that the higher classes of English and French goods find ready sale, to a considerable extent, in almost every civilised part of the world.

"The world-wide celebrity of the 'willow pattern' in crockery, referred to by Mr. Wallis, is another instance of demand, where usefulness and economy are the principal considerations. The wares are well covered by the pattern, and in case of breakages there is no difficulty whatever in replacing them. The 'willow pattern' is to be found almost everywhere, whereas more elegant designs are often difficult, if not altogether impracticable, to replace, or they might require to be made expressly, if the manufacturer can be found, at extra cost and considerable inconvenience. I feel persuaded that the 'willow pattern' is seldom, if ever, bought for the beauty of the design; it is preferred only for its usefulness and convenience; therefore the extensive demand for it ought not to be taken as a proof of deficient taste in the public, no more than the preponderating sale of inferior productions in printed fabrics should be taken as indicating the condition of artistic taste with reference to calico, &c., printing."

Mr. **George Stewart** (of the School of Art, Macclesfield), says:—"I regret to say that it is not possible for me to be present at the reading of Mr. Wallis's interesting paper on 'Progress in Design,' and I feel deeply the compliment you have paid me of offering to take into consideration any remarks I may have to make on the subject. I should scarcely presume to do so, unless as an ally of Mr. Wallis's in his crusade against ugliness, when I may possibly support a small point that might escape the notice of more able warriors.

"As far as my experience extends over the manufactures of this locality, it enables me to bear testimony to the perfect correctness of Mr. Wallis's statement, that a steady and uniform improvement characterises them; and it is my impression that to sustain and increase this progress, but very slight alterations are required in the machinery hitherto employed in its development. One of the main points of change which may be made conducive to the improvements we desire, and which claims immediate attention as a necessity, appears to me to be the giving to manufacturers a clear definition of the critics' 'beau ideal' of manufactured excellence; for at present the manufacturers seem to be under some misapprehension as to the exact point to which we would lead them, as to the precise nature of the improvements required of them. It is customary in our criticisms to characterise improvements as something 'conventional,' severe, precise, symmetrical, geometric; these terms appear in opposition to florid and natural treatment of ornamentation. This language is, perhaps, too technical for general comprehension. Manufacturers unacquainted with the principles upon which it is founded, often connect such commendations with everything that is formal and stiff, repulsive and heavy; in fact, all that is not evidently natural, is supposed to agree with our requirements. The consequences are, that designers and manufacturers, under a momentary pressure of the new theories, concoct together some grotesque combination of architectural forms, as an experiment upon the market; which, naturally failing, they return with renewed avidity to their former styles, and become the most determined opponents to theories which appear to be of so impracticable a character. But let a manufacturer be shown, by good illustrations, that ornamentation may be severe and precise, yet beautiful—symmetrical, yet free; geometric, yet as sparkling as any arrangement of forms treated naturally; and, at the same time, show him the perfect consistency of principle upon which such a system of decoration is based, and he will be, doubtless, much more courageous in the introduction of the innovations we require.

"But let us still further increase this feeling by making use of our existing institutions—our schools of art—as consulting institutions for the designer and manufacturer, when beset with any difficulties as to the fitness of any decoration for its purpose. The manufacturer might thus be indirectly led towards improvement, and a union of interest created between the workshop and the school, which could not but be advantageous to both.

"Having by this means prepared the manufacturer to undertake the production of articles of a new caste, it may next be advisable to consider how far an art influence can be extended over classes who may still place themselves in opposition to the new movement. Such are the commercial agents or buyers, who are said to dictate to the producers what they shall provide, and to the purchasers what they shall consume. Hitherto an art influence has been dependent upon a direct action. The artisan and manufacturer, the representatives of executive skill, have alone engaged the attention of art educators. But the general buyer, or agent, the representative of selective skill, holding a far more commanding position, requires a guiding influence still more than the two classes mentioned. But this influence can only be conveyed in an indirect manner, which might possibly be effected by the dissemination amongst them of authoritative works on art manufacture, of comprehensive works of reference, as, for instance, Chevreul 'On Colour,' which (to my knowledge) is taken by manufacturers and others as a hand-book of daily reference, as an authority, upon all points connected with the arrangement of colour in manufactured goods. Such a fact seems to point out that a similar authoritative work on form, and quantity of form, is simply required to complete our circle of influence, and to relieve a class from an unprofitable position of indecision or indifference.

"It would only remain then to consider what improvements could be introduced in the conveyance of direct influence in the education of the manufacturer and the artisan in our schools of art. But this point may be very properly left to the consideration of the existing authorities."

Proceedings of Institutions.

Cheltenham.—In addition to the usual courses of lectures delivered at the Literary and Philosophical Institution, there have been two courses (one of which is now in progress) delivered to the working classes at the Town-hall. They have included familiar explanations of scientific subjects; the biography of the self-educated; and the character, position, claims, and duties of the working classes themselves; and they have been well attended, and listened to with intelligence and attention. Amongst the lecturers are E. R. Humphreys, LL.D., and Mr. Scougall, of the Endowed Grammar School; T. Wright, M.D., F.R.S.E.; Dr. Lankester; the Rev. Morton Brown, LL.D., and the Rev. C. H. Bromby, Principal of the Training College.

Tunbridge.—On Friday, February 1st, a lecture was delivered in the Town-hall to the members and friends of the Literary and Scientific Institution, by Mr. George Dawson, on the "Life and Times of George Fox, the Founder of the Society of Friends." The lecture was attentively listened to by a numerous and respectable company, who appeared highly gratified by Mr. Dawson's masterly description of this remarkable man, and the eventful time in which he lived. At the close of the lecture a vote of thanks was given to Mr. Dawson. This Institution continues to make steady progress. Several new members have joined the Society this year. A large supply of new books has been received, and a series of lectures, &c., organised for the spring months.

Waterford.—A general meeting of the friends and subscribers of the Mechanics' Institute was held on Friday night, Doctor John Mackesy in the chair. Mr. J. G. Davis (Sec.) read the report of the committee for the past year, giving a most cheering account of the greatly improved working of the Institute. Mr. Davis then read the financial report, after which the adoption, printing, and circulating of both reports was moved by Mr. James

Dobbyn, seconded by Mr. Owen Power, and passed. The Chairman observed, that in the accounts just read there was an item not entered in them, as it properly belonged to the incoming year's account, and that was the profits of the panorama, which amounted to £117. A portion of that had been paid for building purposes, to the Messrs. M'Clelland, in the Institution, and the remainder was to its credit. He (the chairman) hoped the meeting would not separate without coming to a resolution voting a portion of that money to Mr. Davis, for his valuable exertions on behalf of the Institute. Mr. Davis could not think, for one moment, of accepting any portion of this money. The Chairman then recommended that it be an instruction from the meeting to the sub-committee to increase the salary of Mr. Davis. Wm. M. Ardagh, Esq., J.P., bore testimony to the great efficiency of Mr. Davis in carrying on the Institute. At a subsequent portion of the proceedings Mr. Ardagh moved a resolution, which was seconded and passed unanimously, that Mr. Davis' salary be increased. Mr. M'Laughlin (National School Inspector) moved the next resolution, which was the appointment of the following vice-presidents for the ensuing year:—The Dean of Waterford, Rev. J. Crotty, R. Keating, Esq., M.P., John Mackesy, Esq., M.D., William R. Ardagh, J.P., and James Palmer Graves, Esq. In proposing this resolution Mr. M'Laughlin remarked, that there was in the Institution every means of diffusing education among the youth of the city, and he believed that, previous to the establishment of the schools of the Institute, those means were of a contracted kind. He would suggest that half-yearly examinations be established, which would be found to be attended with the best consequences. The resolution, having been seconded by Mr. Clarke, was passed. Votes of thanks were then passed to the outgoing committee, to the treasurer, the donors to the library, and to the chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. Lankester, "On the Recent Progress of Vegetable Physiology."
Chemical, 8.
Statistical, 8, Mr. Charles Jellicoe, "The Bank of England; its Present Constitution and Operations."
Tues. Royal Inst., 3.
Civil Engineers, 8, Mr. W. Heinke, "On Diving Dresses and other Apparatus for Working under Water."
Linnæan, 8.
Pathological, 8.
Wed. Society of Arts, 8, Mr. Maxwell T. Masters, "On the Principles regulating the Transfer of Useful Plants of one Country to Another."
Geological, 8, 1. Professor Harkness, "On the Age of some of the Sandstones and Breccias of the South of Scotland;" 2. Mr. Laurent, "On the Borings in the Valenciennes Coal Field;" 3. Rev. Mr. Dennis, "On some supposed Mammaliar Remains from the Base of the Lias."
Thurs. Royal Inst., 3.
Sat. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 1st and 3rd March, 1856.

Par. No.
70. Incumbered Estates Court, &c. (Ireland)—Return.
72. Newspaper Stamps—Return.
73. Committee of Selection—2nd Report.
35. Bills—Married Women's Reversionary Interest.
58. Bills—Metropolis Local Management Act Amendment.
60. Bills—Out-Pensioners (Greenwich and Chelsea).

Delivered on 4th March, 1856.

64. Wheat, &c.—Return.
45. Bills—Oath of Abduration.
49. Bills—Drafts on Bankers.
59. Bills—Factories.

Delivered on 5th March, 1856.

61. Local Acts (8, Vale of Clwyd Railway; 9, Forest of Dean Central Railway; 10, London, Tilbury, and Southend Railway; 11, Thames Haven Dock and Railway; 12, Milford Junction Railway; 13, Westminster Terminus Railway)—Admiralty Reports.
73. Constabulary Police—Copy of Rules and Regulations.
76. "Josephine Willis" and the "Mangerton"—Copies of Reports.
St. Pancras Workhouse Accommodation—Report.
Turnpike Trusts (Scotland)—Abstract Statements of Income and Expenditure.

Delivered on 6th March, 1856.

68. Digest of Poor Laws—Copy of Correspondence.
69. Russia Company—Copy of Memorial to the Board of Trade.
54. Bill—Bankruptcy (Scotland).
Kars (Defence and Capitulation).
Public General Acts—Cap. 1 and 2.

Delivered on 7th March, 1856.

44. Army Promotions—Return.
80. Chelsea Royal Military Asylum—Return.
64. Bills—Bleaching, &c., Works.
65. Bills—Wychwood Forest.
Indian Law Commissions—First and Second Reports.

Delivered on 8th and 10th March, 1856.

3. Duchy of Cornwall—Account.
59. Works and Public Buildings—Abstract Accounts.
77. Joint Stock Companies—Report by the Registrar.
81. Military Savings Banks—Accounts.
86. Assaults on Women and Children—Return.
66. Bill—Railway and Canal Traffic.
40. Bill—Minister's Money (Ireland).
Department of Science and Art—Order in Council.
Births, Deaths, and Marriages (Scotland)—1st Annual Report of the Registrar General.

Delivered on 11th March, 1856.

84. Paupers—Returns.
67. Bill—Vaccination.

Delivered on 12th March, 1856.

41. Local Acts (14, Lymington Railway; 15, Maybole and Girwan Railway; 16, Isle of Wight Steam-Bridge and Approaches—Admiralty Reports.
83. Railway and Canal Bills Committee—First Report.
90. Civil Services Estimates—Class 2.
93. Railway and Canal Bills—Report of the Board of Trade.
Agricultural Statistics, Ireland—Tables.
Public General Acts—Cap. 3, 4, 5, and 6.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette March 7th*, 1856.]

Dated 1st December, 1855.

2711. Sir Charles Edward Grey, 38, Rue du Mont Thabor, Paris—The use of a new vegetable material for raising the nap and dressing woollen cloths and webs and tissues.

Dated 11th January, 1856.

87. William Smith, Little Woolstone—Improvements in ploughs, and other cultivating implements.

Dated 16th January, 1856.

111. Thomas Dunn, Windsor Bridge Iron Works, Pendleton—Improvements in boilers and apparatus for heating water and generating steam.

Dated 25th January, 1856.

205. Gentle Brown, Swinton, near Rotherham—Improvement in the manufacture of cast steel.

Dated 9th February, 1856.

343. John Elce and Samuel Fletcher Cottam, Manchester—Improved mode of lubricating the spindles of machinery used in preparing and spinning cotton and other fibrous materials revolving in a lifting rail.
349. Theodule Cavé, Paris—Improvements in oil lamps, which he calls the "Continual Lamp."

Dated 11th February, 1856.

353. William Henry Zahn, New York, and Joseph Henry George Wells, 3, Ebenezer-place, Neckinger-road, Bermondsey—Improvements in wind mills or wind engines.
355. Thomas Steven, Milton Foundry, Glasgow—Improvements in the construction of open and close stoves, which improvements are applicable in part to kitchen ranges and boiler fire-places.

Dated 12th February, 1856.

357. Joseph Marie Guidicelli, 34, Rue Bonaparte, Paris—Improvements in the transformation of movement in steam-engines and other machinery.
359. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of cast steel. (A communication.)

Dated 13th February, 1856.

361. Frederick Steiner, Accrington—Improvements in machinery to be used in drying fabrics.
365. William Frederick Collard Moutrie, 4, King-street, Holborn—Improvement in the damper action of piano-fortes.
367. Richard Knight, Foster-lane—Improvements in medical chests.
369. William Edward Newton, 66, Chancery lane—Improvements in the manufacture of zinc. (A communication.)
371. Alfred Vincent Newton, 66, Chancery-lane—Improvements in springs applicable to railroad carriages, and to other uses. (A communication.)
373. John Barber, Manchester—Improvements in steam-engines.
375. William Parsons, 33, Hugh-street, Pimlico—Improvements in spindles for locks and latches.

Dated 14th February, 1856.

379. Stephen Rossin Parkhurst, New York—Improvements in sails and rigging for vessels.
380. Walter McFarlane, Glasgow—Improvements in building and structural works, and fittings in metal.
381. John Emsley, Bolton-road, Bradford—Improvements in tube spinning frames employed in spinning worsted-yarn and other fibrous substances.
383. John Taylor, Spring-grove, Hounslow—Improvement in constructing and facing walls.
385. Edmund Morewood and George Rogers, Enfield—Improvements in drying and coating iron and copper.
386. William Watson Hewitson, Headingley, near Leeds—Improvement in casting the bearings or brasses of machinery.
387. Thomas Evans Blackwell, Clifton, near Bristol—Improvements in condensing steam, and in cooling and heating fluids.
389. George Gulliver and John Goldthorpe, Barnsley—Improved signal bell.

Dated 20th February, 1856.

424. Richard Laming, Carlton-villas, Maida-vale—Improvements in purifying gas, in preparing materials useful for purifying gas, and in apparatus to be used in purifying gas and disinfecting gas liquors or washings.
426. William Muir, Britannia Works, Manchester—Improvements in slide lathes.
428. William Lynn, H.M. Dockyard, Portsmouth—Improvements in the construction and mode of applying screws for propelling vessels.
430. Richard Archibald Brooman, 166, Fleet-street—Improvements in working railway switches and crossings, and certain indicating apparatus for preventing accidents on railways. (A communication.)
432. William Clibran and Joseph Clibran, Manchester—Improvements in and applicable to apparatus or mechanism for measuring and regulating the flow of gas, and in the mode of constructing parts thereof.
434. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for lubricating bearings, parts of which improvements are applicable to the raising or elevating of liquids. (A communication.)

Dated 21st February, 1856.

440. Isaac Moll, Cologne—The treatment of sulphate of alumine of commerce, and its formation of compounds useful for the disinfecting of organic substances in a state of putrefaction, as well as for other purposes.
442. Jacques Henri Marie Maissiat, Paris—Improvements in projectiles for fire-arms.
444. Thomas Bennett and Wilfred Preston Dugdale, Farnworth—Improvements in flyers used in spinning machinery.
446. Frederick Enthoven, Moorgate street—Improved cover for gunpowder and other canisters and vessels. (A communication.)
448. William Clarke, Nottingham—Improvements in the manufacture of warp fabrics.

Dated 22nd February, 1856.

452. John Sharp Cromactie Heywood, Battle-bridge, and George Lloyd, Great Guilford-street, Southwark—Improvements in condensing vapours in distillatory operations, the manufacture of varnishes, melting and distilling of fats, and other manufacturing or chemical operations, and obtaining useful products therefrom.
454. John Kingsford Field, Lambeth, and Charles Humfrey, 14, The Terrace, Camberwell—Improvements in the manufacture of paraffine candles.
456. James Griffiths, Wolverhampton—Improved brake for colliery and other steam-engines.

Dated 23rd February, 1856.

460. Edward Schischkar, Halifax—Improvements in cleansing silk, hair, wool, yarn, and textile fabrics.
464. George Holme Spencer, Heathersage, near Sheffield—Improvements in the manufacture of card surfaces employed in carding cotton and wool.
466. Thomas Goode Messenger, Loughboro'—Improvements in boilers.
468. Joseph Scudamore, Mitcheldean, Gloucester—Improvement in domestic stoves or grates.
470. Henry Loveridge, Wolverhampton—Improvement in feet, hip, and slipper baths, also in bases for shower baths and basins for washing, and other purposes.
472. Samuel Rodgers Samuels, Nottingham—Improvements in weaving fabrics.

Dated 25th February, 1856.

474. Louis Normanby, 67, Judd-street, Brunswick-square—Improvements in the mode of constructing and fixing the rail of railways. (A communication.)
476. Frederick Kersey, 5, Laurie terrace, St. George's-road, Southwark—Improvement in the manufacture of drain pipes.
478. Robert Hawthorn and William Hawthorn, Newcastle-upon-Tyne—Improved arrangement of steam pump.
480. Charles Frederick Claus, Latchford, Chester—Improvements in metal shipbuilding, applicable also to steam-boilers, bridges, and other structures in which metal plates are used.
482. Charles Dames Auguste Joseph Planque, Pont St. Maxence, France—Improvements in the manufacture of fecula.
484. Edward Slaughter, Avonside Ironworks, Bristol—Improvements in the fire-boxes of locomotive and other steam boilers.

Dated 26th February, 1856.

486. James Prescott Joule, F.R.S., Manchester—Improvements in steam-engines.
490. James Steedman, Albany-street—Improvement in piano-fortes.
492. Philip Schafer and Frederick Schafer, Brewer-street—Improved apparatus for damping gummed stamps, tickets, labels, and envelopes.
494. Richard Archibald Brooman, 166, Fleet-street—Compositions to be used as a substitute for hops in brewing. (A communication.)
496. Isaac Reckitt, George Reckitt, and Francis Reckitt, Kingston-upon-Hull—Improvements in the manufacture of starch, British gum, and size.

Dated 27th February, 1856.

498. Gabriel Marie Legrand, 57, Rue de Bretagne, Paris—Improvements in graining and chequering skins and woven tissues.
500. John Henry Johnson, 47, Lincoln's inn-fields—Improvements in the treatment of hard india rubber for the purpose of rendering the same applicable to the manufacture of pens, tubes, springs, and other similar articles. (A communication.)
502. William Exall, Reading—Improvements in the manufacture and arrangement of sawing machinery.
504. Alexander Inglis, New River Head, Clerkenwell—Improvement in the manufacture of flexible bottles or cases for containing colours and other fluids and semi-fluids.

WEEKLY LIST OF PATENTS SEALED.

Sealed March 7th, 1856.

2022. Florentin Garand.
2031. Eugene Hippolyte Rascol.
2033. Joseph Henry Tuck.
2106. Richard Archibald Brooman.
2113. George Arthur Biddell.
2506. William Johnson.
2821. John Henry Johnson.
2879. James Fleming, junr.
160. John Wordsworth Robson.

Sealed March 11th, 1856.

2062. Joseph Partridge and John Kirkham.
2067. Pierre Bernardet de Lucenay.
2070. Joseph Henry Tuck.
2071. Abram Longbottom.
2074. William Church.
2075. Théodore Gomme, junr., and Charles Eugene Auguste Beaugrand.
2082. Joseph Gilbert Martien.
2090. Alfred Ford.
2092. Joseph Lewtas.
2114. Samuel Coulson.
2122. John Dale.
2123. George Seaborn Parkinson.
2142. Frederic Rainford Ensor.
2291. John Deurance.
2822. George Hall Nicoll.
2856. Andrew Small.
32. William Simmons.
170. Dundas Smith Porteous.

Patents on which the Third Year's Stamp Duty has been Paid.

March 1st.

5646. Joseph Maudslay.

March 3rd.

1026. William Frederick Thomas.

March 4th.

651. Charles Heard Wild.

March 5th.

608. John Powis and Jabus Stanley James.

March 6th.

621. William Muir.
657. John Livesey.

March 7th.

601. George Collier.

March 8th.

612. The Honourable William Erskine Cochrane and William Marshall Cochrane.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3816	March 11.	Improved Shirt Neck Band or Collar ...	James Flanagan	Manchester.
3817	March 12.	A Stove or Furnace for Heating Hatters' Irons	John Clayton	Denton, near Manchester.

Journal of the Society of Arts.

FRIDAY, MARCH 21, 1856.

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FOURTEENTH ORDINARY MEETING.

Wednesday, March 19th, 1856.

The Fourteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 19th inst., Dr. J. Forbes Royle, F.R.S., in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Fraser, James William.
Hutchison, John.
Keeling, Henry L.
Llewelyn, J. D.
Metford, William Ellis.
Moore, E. W.
Smith, William.

The paper read was

ON THE PRINCIPLES REGULATING THE TRANSFER OF USEFUL PLANTS OF ONE COUNTRY TO ANOTHER.

By Maxwell T. Masters, Lecturer on Botany at St. George's Hospital, London, and Sub-Curator of the Fielding Herbarium, Oxford.

At a time when the earth is ransacked in search of new materials to supply the requirements of commerce; when means are devised whereby the supply and culture of the old materials may be increased or extended; at such a time it has been thought by the Council of the Society "that the enunciation of the general principles that should regulate the introduction of useful plants for cultivation into any country, would have a beneficial effect in preventing the loss and disappointment that arise from well-meant but injudicious attempts to transfer the productions of one country to another." If, in treating this extensive subject, I confine myself to principles, it will be for the reason that, however imperfect my appreciation of the principles, my lack of acquaintance with the practice must be yet greater. If we would command Nature, we must obey her laws.

The laws that regulate the natural diffusion of plants over the surface of the globe, or, at least such among them as are in action at the present epoch, must, when subjected to certain necessary modifications, be our best guides in the attempt to naturalise a plant in a foreign country.

The study of these laws constitutes the science of Botanical Geography—a branch of knowledge which, if it may not be said to have originated in, at least received its first great impulse from, the comprehensive mind of Alexander Von Humboldt. The wide field of observation and speculation that it embraces—its dependence on the other branches of knowledge, combined with the extensive acquaintance with vegetable physiology and systematic botany that it demands, have sufficed to raise this young science to a very high rank.

It must further show its right to hold such a position, by contributing to the relief of the necessities and the increase of the comforts of mankind. Its capabilities in this respect will be very great; already its conclusions tally well with the results of experience; and were its warning voice heeded, the sources of failure would be greatly diminished. As the science waxes stronger and stronger, so will its power of conferring direct benefit increase. We do not look for support from an infant; but from an infant of such promise as is this science we may very confidently look for great assistance hereafter. Be it my task now to allude to some among its principles that appear to me to be more or less capable of a practical interpretation.

The diverse vital endowments and the varied structure of plants impose on them different conditions of existence. Unless these conditions are complied with, the *life* of the plant cannot be sustained. Climate was early recognised as the most important of the physical agents that influence the life of plants. The intimate relation that exists between the variety of vegetable products and the diversity of climate is obvious. In attempting, then, to naturalise a plant of one country in another, one of the first things to be inquired into is as to the similarity that exists between the climate of the two places. Some of the elements that constitute a climate appear to be of infinitely greater importance to vegetation than others, and these are the only ones that need at present occupy our attention. Foremost in importance is temperature. At the outset, then, we have to apply to the meteorological observer for a knowledge of the climatal conditions of the two countries. It may be that no data exist. But even where they do exist, and for meteorological purposes are tolerably correct, yet, in many cases, their applicability to geographical or cultural botany is not only partial, but such that it would lead to false inferences. Thus, the attempt to reconcile the facts of the distribution of plants according to meteorological conditions alone frequently fails. Plants rebel against isothermal and isochimenal lines; they will not be tied down by mean monthly temperatures, still less by mean annual ones. Hence the necessity of devising some other means whereby the records of the thermometer may be made available for cultural purposes. Boussingault, by calling in physiology to the assistance of meteorology, has partially effected this. He judged that a plant requires a certain aggregate amount of heat in order to live; a certain larger amount to enable it to perfect its flowers, ripen its seeds, or elaborate its secretions. He calculated the quantity of heat so required, by observing the mean temperature of the period occupied in the performance of this or that function. Then, by multiplying the mean temperature by the number of days, he obtained a product which represented the *sum* of the temperature required by the plant.

The sum is nearly the same in all countries capable of affording the requisite amount; as increased duration of heat compensates for its deficient intensity.

This method, though liable to many objections, is still partially applicable to tropical countries, or to localities having an equable climate free from extremes of heat or cold.

M. A. De Candolle, in his most elaborate work on Botanical Geography, recently published, points out numerous sources of error in M. Boussingault's plan; and one of which is of too great importance to be here passed over. It is, that in this method, degrees of temperature that are either useless or noxious to the plant, are liable to be included, as well as those that are useful. This objection applies, with still greater force, to calculations based simply upon the results of thermometric observations, without considering the growth of the plant during the interval of which the temperature is calculated. For instance, it is well known that a temperature of 32° Fahr. puts a stop to the activity of vegetation in all plants. Many plants, too, will not bear so low a temperature as 40° Fahr., except for a short period. M. De Candolle particularly urges the recognition of the fact that temperatures below 32° Fahr. are not necessarily more injurious than the temperature of the freezing point. All degrees below this point are simply useless, as far as the plant is concerned. The plant remains dormant. Hence, M. De Candolle proclaims the necessity of rejecting from the meteorological tables, that are to be applied to the facts of vegetation, all temperatures below the freezing point. The application of this correction to the thermometric records we possess, would be too immense a labour to be accomplished, even if the necessary data were accessible; for it would be necessary to know, not only the *mean* temperatures, but also the figures from which those means were computed.

By way of illustration, M. De Candolle has applied this correction to the records of the thermometer at Geneva, during those months in which frost is likely to occur.

From his table I will select one or two examples. The mean temperature for December, 1844, calculated according to the ordinary method, was 31°.6 Fahr.; whereas, if the degrees useless to the plant are excluded, the mean is 33°.7 Fahr. In January, 1845, the mean temperatures, calculated by both methods, were respectively 34°.1 and 35°.2 Fahr. In February, 1845, 27°.2 and 34°.3.

Hence it is that certain alpine plants, in the neighbourhood of Geneva, may experience a certain useful amount of temperature, which enables them to flower at a time, when, according to the mean temperature, as ordinarily calculated, they would be unable so to do. The difficulty or impossibility of making similar calculations for all places of which the mean temperature is known, has led M. De Candolle to suggest another method, whereby the error resulting from the calculation of useless degrees of temperature may be in some measure avoided. He proposes to take, as a starting point from the ordinary meteorological tables, the day in spring on which the mean temperature rises above a certain degree, say 33° Fahr., then to ascertain the day in autumn or winter having the same mean temperature, and to calculate the aggregate amount of heat during the interval, by Boussingault's method, that is to say, by multiplying the number of days by their mean temperature.

It will be remarked that there may have been days before the one selected as a starting point, on which the temperature may have arisen above 33°, although the mean temperature may not have risen above that degree. This error, M. de Candolle thinks, is compensated for by the converse fact, that the temperature may fall below 33° after the day fixed on as a starting point; so that the high temperatures that occur before the time fixed on are balanced by the low temperatures that occur after. This method is of course only approximative.

As many plants will not bear a temperature even of several degrees above the freezing point, and as each plant has probably, as it were, a zero of its own, below which it cannot exist, so it becomes necessary to adopt this, or some other method, for degrees above 33° up to 40° or 50°. And this is so much the more necessary, because although a plant may live and perform certain of its functions when submitted to an aggregate heat of so many degrees, it may require a larger amount in order to perform other of its functions. We have abundant illustrations of this in the fact that certain plants able to resist our inclement climate, are nevertheless precluded from producing their flowers, or from elaborating the gum, the resin, or other secretion, which in a hotter clime give a value to the plant that it cannot attain here.

In order to show how it is that certain plants are common to, or may be cultivated in, two localities having a very different climate one from the other, M. de Candolle compares the climate of London with that of Odessa. The mean summer temperature of London is 62° F., that of Odessa, 68° F. The difference in the winter temperature is still greater, and the monthly means present no analogy. But, if the day on which the mean temperature arrives at 40°.1 F., be ascertained, and also the day when the temperature sinks to the same point at both of these towns, and the aggregate temperature of the interval be calculated, it will be found that this aggregate amount is nearly the same for both places. In London, the mean temperature of 40°.1 F. begins on or about the 17th of February, and the thermometer falls to the same point on or about the 15th December.

The aggregate heat of the interval amounts to 6207°.8. At Odessa, the mean temperature of 40°.1 Fahr. occurs first on the 2nd or 3rd day of April, and on the 17th or 18th of November the same mean temperature is indicated by the thermometer. The duration of the interval is shorter, but the intensity of the heat is greater, and hence the sum of heat is nearly the same as in London—viz., 6193°.4 F. Hence plants that require a heat of at least 40° F., and a sum of heat amounting to 6200°, or thereabouts, will find in both places the requisite conditions.

Up to this point, the effect of temperature on plants has been considered mainly in reference to the influence of cold. Excessive heat is also injurious, though its effects are more difficult to measure, as they are so intimately blended with those produced by a contemporaneous deficiency of moisture. It behoves us, however, not to imagine that a temperature of 80° must necessarily produce twice the effect of a heat of 40°.

The state of the plant, too, in all considerations of heat and cold, must be attended to. The plant which will at one time resist a temperature of 32° F., at another time will perish at 35° F. Much depends upon the period at which the plant is subjected to cold. A plant when at rest can support a very much lower temperature than when vegetation is active, hence it is that the intense cold created by nocturnal radiation is in many cases productive of but little mischief. Sudden transitions from a low to a high temperature are generally admitted to be injurious to vegetation. But to this, even, there are many exceptions. Witness the temperatures recorded by Sir Thomas Mitchell at various places in New Holland. In May (our November), within three or four degrees of the tropic, the thermometer, at dawn, indicated temperatures as low as 20°, as 17°, nay, even as low as 11°. At noon on the same days, the thermometer stood respectively at 82°, 69°, and 67°. At nine in the evening we read respectively—38°, 30°, and 27°.

Furthermore, it will be remembered that perennial plants and trees are subjected to the whole annual range of temperature, whilst the so-called annual plants have an existence of but few months. From this latter class the vegetable food of man is principally derived, and hence he is able to combat successfully with the extremes of drought or cold.

It is scarcely necessary to do more than allude to the decrease in temperature in relation to increased altitude. Attention to this fact renders the culture of plants, natives of temperate climates, possible in the tropics.

At the equator, according to Humboldt, an elevation of nearly 7,000 feet is required for the successful culture of European cereals.

The late M. de Candolle pointed out an analogy between sea-side plants and those growing on mountains, and showed how the denizens of the one situation might frequently be more successfully cultivated in the other locality than elsewhere.

The temperature of the soil is also a point worthy of attention. It is ever less variable than the temperature of the air. In temperate climates the soil is warmer in winter than the atmosphere, and slightly colder in summer; but in the tropics, it would appear that the soil is always warmer than the air.

For agricultural purposes, it is only the superficial layers of soil that need be attended to. The roots of few cultivated plants descend below three feet; by far the great majority do not penetrate so deeply. But inasmuch as the temperature of the soil varies less, and is higher as the depth increases, so plants whose roots penetrate deeply will, *cæteris paribus*, resist cold better than those whose roots are more superficial—a fact in favour of the newly introduced Chinese yam, whose habit it seems to be to descend to a considerable distance in the soil.

The mechanical nature of the soil has, as has been shown by Professor James Forbes, a considerable influence on its power of conducting and retaining heat. Nor must we overlook the fact that the temperature of the soil is in some measure under our control, as shown by the effects of drainage.

The data for ascertaining the heat of the soil are far less numerous than those that afford us a knowledge of ærial temperature. Mr. Thompson, to whom we are indebted for the excellent meteorological observations carried on in the garden of the Horticultural Society at Chiswick, has proposed an approximative method for ascertaining the temperature of the soil from that of the air supposed to be known. Thus, at Chiswick, he finds that the temperature of the soil in winter is from 2° to 3° higher than that of the air. Hence, for places having about the same mean monthly temperature as Chiswick, during the winter, an addition of 2° or 3° to that mean will give the heat of the soil.

For localities with a colder winter temperature 2° or 3° more must be added; and, in some places, 8° or 9°, according to the severity of the winter.

In summer (in temperate climates) we have to subtract from the temperature of the air to ascertain that of the soil. In the tropics, an addition of from 2° to 4° must be made throughout the year. Dr. Lindley's Theory of Horticulture contains a table, constructed by Mr. Thompson, which gives the temperature of the soil at different places, as observed or calculated by the foregoing method, during the seasons in which the plant is growing, ripening, or resting.

The immense influence that light has on vegetation, is not a matter for doubt, though it is difficult to measure precisely its effects. M. Alphonse de Candolle endeavoured to estimate the effect of exposure to full solar light, by watching the growth of plants in the shade, and that of plants fully exposed to the sun's rays. He found that the plants that were exposed grew in a shorter period, and thus received a smaller aggregate amount of heat (as measured by a thermometer in the shade) than those grown in diffused light, owing to the longer duration of growth under the latter circumstances. The difference in the quantity of heat experienced by the plants under the two conditions, thus affords a measure of the *direct* calorific or chemical effects of the sun's rays—a measure expressed in degrees of a thermometer in the shade.

Thus it is, that in climates blessed with an unclouded sky, the amount of *heat* required is less than in countries where the atmosphere is nebulous and overcast.

Thus it is also that certain plants can grow farther north in Norway than they can in Scotland.

Experiments are not wanting to show the relation that exists between the chemical ingredients of plants and the light to which the plants are exposed. The formation of aromatic and other secretions, is at least as much under the influence of intense light as of exalted temperature—probably more so; hence the desirability of ascertaining the relative transparency of the atmosphere and the intensity of the light in different countries.

The humidity of a country is a point of the greatest importance. Not only is it necessary to know the amount of rain that falls during the year, but its frequency and amount in different seasons. Dividing the duration of the life of an annual plant into two principal epochs, that of growth and that of ripening, its cultivation is likely to be the more successful as the rain falls during the growth, and ceases during the maturation, at which latter period a high temperature is more advantageous.

M. de Gasparin cites, in illustration of the necessity of paying attention to the time at which the rain falls, the fact that the introduction of cotton into the South of France was unsuccessful, mainly on account of the early appearance of rain in autumn. In Sicily and Algiers, where the occurrence of rain is longer deferred, the culture has met with success.

The effects of heat and moisture combined, are to produce luxuriant foliage to the detriment of the flower and fruit; in certain instances this would be desirable, as in the culture of plants for forage.

But where the two elements are in due proportion, the combination is the most fortunate one that can happen. Too often is it that with intense heat there is a corresponding deficiency of moisture, a state of things offering the most formidable resistance to the successful introduction of plants destined to flourish in a less ardent clime. The vegetation in some of these hot arid regions consists in great measure of the so-called succulent plants, amongst which is the Cochineal cactus. Bulbous plants also flourish in such like districts. Sir John Herschel records the temperature of the soil of his bulb garden at the Cape of Good Hope as sometimes reaching 159° Fahr.

The effects of forests on the humidity of a climate, and the injurious consequences that result from their indiscriminate removal, are matters to which the attention of the legislature and the public has of late been called.

Before leaving the subject of moisture, I should wish to refer to a remarkable instance of the successful application of scientific knowledge to practical purposes. Availing himself of the hygrometrical qualities possessed by mosses, Colonel Nichols fostered the growth of these plants in the rocky island of Ascension, and is thus reported to have obtained an ample supply of water where there had previously been a deficiency.*

What the influence of the electrical conditions of a climate on vegetation is, is scarcely known, though it would seem probable that it may be considerable.

To the agriculturist in districts where storms are frequent, as in the tropics, the violent hurricanes and torrents of rain that accompany them, must be matters of no little moment.

The direction and force of the wind is also a climatal element of importance, even when not manifesting its powers in the excessive manner just alluded to.

The culture of the hop would be attended with many difficulties in a country frequently liable to high winds.

The coarseness of the fibre of hemp, when subjected to such influences, has been not unfrequently remarked.

Soil is not an unimportant subject to be considered, though it is probable that plants can bear a greater deviation from the nature of the soil they prefer than from almost any other requisite condition.

It was the opinion of the late Dean Herbert that wild plants did not necessarily grow in the soil that was best suited to them, but that they grew where they were not subjected to the encroachments of stronger neighbours. Still, it does not admit of doubt that the culture of certain plants has proved impossible or unprofitable from a lack of the soil most congenial to the plant. To this is attributed the small success attending the culture of sugar, cotton, indigo, and tobacco in Ceylon.

Such, then, are some of the more prominent physical circumstances that regulate the natural diffusion of plants over the surface of the globe,—the more important, as they are, comparatively speaking, immutable. Not so inflexible are the vital powers of plants.

Doubtless, each plant would thrive best in a certain temperature or soil; but it is endowed with a power of deviating from this standard, such deviation being limited, and varying in amount in different species.

We have to ascertain by experience what the natural constitution of plants really is.

As for actually changing the constitution of a plant, the thing is impossible; all we can do is to test its flexibility or its power of adapting itself to different circumstances. It by no means follows that the larch is hardier now than it was when sheltered in a greenhouse; simply, its capabilities of resistance were then unknown.

The wonderful results that have been consequent on the efforts of man to avail himself of the almost cosmopolitan habits of certain plants—the success that has been attendant on the trials made on plants with lesser powers of adaptation, hold out great hopes for the future.

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* Vide *Gardener's Chronicle*, 1855, p. 757.

Very many unsuccessful experiments may be attributed to the neglect of scientific principles. True, that science is at present extremely imperfect, but still she is our safest guide in experiments of this kind. In support of this, let me cite the opinion of one whose successful and unremitting labours in this department well qualify him to be a judge in such a matter.

"Scientific investigations," says Dr. Royle, "are, in fact, the only means we possess of obtaining any principles for our guidance in experimenting on the improvement of old products, or in the introduction of new ones into the culture of a country, and by which we can have anything like certainty in the results we are likely to obtain. The absence of such guides in the numerous experiments that have been made in India may explain the almost constant want of success."

To those who are familiar with what is, and has been, effected by means of the Botanic Gardens of Kew, of Calcutta, Saharunpoor, and of many others in our colonies—to those who appreciate the capabilities of scientific societies, at home or abroad, it will not seem strange that I should refer to them as affording the greatest facilities for carrying on such experiments. In some cases, I fear, the value of such institutions is overlooked or ill-understood.

In an experimental garden, not only the power of a plant to resist or adapt itself to altered conditions might be tested, but the conditions themselves might be fully investigated. Thus might meteorology confer great aids on cultural botany. The observations which would seem to be most useful for cultural purposes are those which enable us to ascertain the duration and intensity of useless and of useful temperature—the heat of the soil—the time at which rain falls, and in what quantity—the length of the intervals without rain—the humidity of the atmosphere—besides other circumstances which would be prompted by the peculiarities of the locality, or the special requirements of certain plants.

The judicious selection of plants appropriate to the conditions afforded by the country, and to its requirements, would thus be greatly facilitated.

There need be no fear that the economic limitations, if I may so call them, would be neglected. The expenses of culture, the abundance and cost of labour, the means of transport, the machinery required, the fiscal regulations, all these, and similar circumstances having reference to the successful introduction and culture of plants, might be investigated under such auspices.

As an illustration of this, I may be allowed to quote from the report of the Ceylon Botanic Garden, as reprinted in the *Journal of Botany*. Speaking of plants yielding useful fibres, the Committee recommend that, "a popular account should be published in the English and native languages of the plants producing the fibres, the most economical way of preparing them, the cost of labour per hundredweight, &c." The report further says, "that, in order to render any discovery largely beneficial to the colony, it is indispensable that it be suited to the habits of the mass of the people, and of a nature likely to be adopted by them."

One other important element in the success of an experiment may be secured in such an establishment—to wit, Patience. How often does it not happen that after one short trial the experimenter feels obliged to turn his attention to other matters that afford a quicker return? And yet, in many instances, a longer trial—a slight change in the mode of culture—might conduce to the desired end. Time, too, is one of the most potent agencies in overcoming Prejudice—that fertile source of obstacles to the successful introduction or culture of new resources.

A ~~paper on the transfer of plants would hardly~~ be complete without some reference to the best mode of conveying plants on long voyages. But, if much of what I have previously said be trite, so what I can say concerning the mode of transfer must be still more so.

The paramount utility of Wardian cases, in which plants are conveyed in a living condition from country to country, has now long been recognised. Each day confirms the opinion that this mode, where practicable, is the best that can be adopted. Mr. Moore, the curator of the Glasnevin Botanic Garden, thus writes to me in reference to this point:—"I can without hesitation state the Wardian case to be by far the best method to take for importing and exporting living plants. As a proof of this, I have had coniferous and other plants sent to this establishment, which were taken from their natural habitats in the island of New Caledonia, come quite safely, after having been shut up for five months."

The other methods of transporting living plants, are based upon the principle of keeping the activity of the plant dormant during the voyage—of keeping the plant at rest.

The transmission of seeds occasionally presents difficulties. Generally it is found that dryness and free exposure to the air, are the greatest safeguards against premature germination. Some seeds, which present more than ordinary difficulties, may be coated with wax, and thus, by excluding oxygen gas, and preventing either the absorption or the loss of moisture, the vitality of the seed may be preserved. In this way Dr. Royle has succeeded in conveying chesnuts and filberts to the Himalaya when other means have failed.

Trite and ill-digested as many of the remarks made must have been, I would fain hope to have drawn attention to the fact, that there are points in Botanical Geography already discovered of great importance to practical men—facts which, like those afforded by the other sciences, may be made available—

> "for profit of the people;
> For advantage of the nations."

DISCUSSION.

Mr. P. L. SIMMONDS said, the subject which had been opened for consideration by Mr. Masters that evening was one of great importance to Great Britain, possessing, as she did, colonies and dependencies in almost every parallel of latitude. And while we had had the principles which should be borne in mind, in transferring plants from one region to another, so clearly laid down, we were also exceedingly fortunate in having in the chair that evening a learned professor, who had devoted almost a life-time to the consideration of this very subject, especially as regarded the introduction and successful culture of all the useful staples and plants into the widely varied climates of India. Those who were familiar with his many valuable works, from the "Botany of the Himalaya Mountains," the "Productive Resources of India," the "Culture of Cotton in India," down to his latest work on the "Fibrous Plants of India,"—would feel that, combined with his long experimental experience in India and his continued labours in that peculiar field of utility, as exemplified in the valuable collections he arranged for the Exhibitions at Paris and London, no one was better fitted to deal practically with the subject in its various details. Without the advantages of theoretical science, practical knowledge was of little avail. Residents and cultivators might discover the properties of unknown plants and trees, but it remained for Science to turn them to their full advantage, and to point out the climates, soils, and localities suited to their growth. The Flora of many of our colonies was still to a great extent undescribed; of the Cape Colony and Natal, we as yet knew little; Ceylon and Australia still offered a wide field for investigation. Dr. Ferdinand Mueller, the Government botanist of Victoria, in the progress of an extensive tour through that colony a couple of years ago, brought to light many useful and heretofore unknown plants; and in his report he stated, "seeds of the indigenous plants have been collected during my journey, as far as season and opportunity permitted, not only for our own establishment, but have also been distributed, to the amount of nearly 2,000 lots, to the Royal Gardens at Kew, the Botanical Gardens of Hobarton, Sydney, Capetown, Mauritius, Calcutta, &c." "We possess (he adds) in the southern hemisphere what the ancients in the northern called *regiones felices*, those happy latitudes of a warm temperate zone, in which nature with a prodigal hand offered prominently, amidst so many other gifts, the cerelia, the olive, and the vine, and to which we here have added, from the far east, the orange and the tea; from India, the rice; and from the New World, the maize, cassava, arrowroot, tobacco, and many other treasures of the vegetable world, on which mankind now rely for luxury and support. All these may be here successfully produced, along with those which we enjoyed in the country of our youth." There were numerous curators of botanic gardens and Government botanists, scattered through our several colonies, but there appeared to him to be less practical benefit derived from their individual labours, than might apparently result from their collective experience and interchange of communication, if they were less isolated in their exertions, and were brought more frequently into correspondence with each other, under some general supervising system. The under current of practical utility might, however, flow silently on, although the result of their labours was not made so generally public as could be desired. And here he would throw it out as a hint, whether the Society's Journal might not be made more frequently the receptacle of information as to the acclimatization of certain plants, the results of experiments as to their introduction, the requirements of particular localities, and so on. In a recent Cape of Good Hope paper he found it stated:—"The little interest shown by the inhabitants of Cape Town in the proceedings and progress of the Botanical Garden Commission, is greatly owing to the want of publicity. No report has been published for years. Work is being done, and improvements are being carried on in the establishment, of which the public generally have not the slightest knowledge. In the evidence attached to the report of the Assembly Committee on the subject, more information has been brought to light than had ever appeared before." We found that most of the principal European and West Indian fruit trees had been introduced and acclimatized in the Cape Colony. The introduction of timber-producing trees had occupied a proper share of attention, Strictly tropical trees had not succeeded well, as might have been anticipated from the situation and exposure; the teak tree had perished altogether; the mahogany and banyan trees, however, seemed to thrive. Many of the European trees, as the ash, the elm, and the sycamore, had made rapid growth. The handsome Indian cedar (*Cedrus deodara*) stood the climate well. Too much could not be said in favour of this valuable tree, whose wood was said to be almost imperishable. The tree itself attained an immense height, and was said to be the most noble of the many noble trees on the Himalaya. The absence of publicity, to which he had alluded was, however, too frequently the result of a want of leisure for correspondence. Thus Mr. M'Gibbon, of Cape Town, in his last report to the commissioners of the Botanic Gardens, stated—"Much of my time, which ought to be devoted to other objects, such as preparing the herbarium, naming the plants, &c., is taken up with actual labour, which, in other places, is usually performed by competent assistants." And yet his report pointed out how much was being done there, the issue of plants from the garden exceeding 14,000 in the year; and he instanced numerous and important additions which had been made to the exotic flora of the colony. There might be some little truth in the following remarks by Dr. Smith, an enthusiastic experimentalist on tea culture in America. He observed, "It may be doubted whether a botanical garden, however able the professor presiding over its interests may be, is exactly the place for a successful experiment. A gentleman who has all the exotics that can be collected from the four quarters of the world under his charge, can scarcely be said to occupy a position that would best qualify him to superintend the cultivation of any new plant upon a national scale. By directing his attention to a great variety of agreeable objects, and spreading his paternal care over so large a family, he, in some measure, disqualifies himself for that constant, minute and practical attention to the plant which, especially when under experiment, it demands at his hands. Such an enterprise requires the infusion of a degree of enthusiasm,—a devotion to the one great object in hand; an attachment to cultivation and horticultural pursuits for the love of them; an untired patience and ardent zeal in communicating instruction to others, upon the subject most immediately in hand, rather than upon the general science of botany; particulars which can hardly be expected from a professed botanist." Most of the European esculent vegetables had been successfully introduced into the East and West Indies, Australia, and the Cape Colony. The cereals and legumes of Europe, however, scarcely gave sufficient returns in tropical climates, even in the elevated regions, for the care and expense attending their cultivation. The fodder plants of Europe, when taken to the East Indies, had not generally succeeded, with the exception of lucerne, which was now largely cultivated in the Bombay presidency by the natives. The Guinea grass and the Mauritius grass might be more generally diffused with advantage. The latter flourished in marshy soils. A Brasilian grass, the *Panicum spectabile*, though growing to the height of six or seven feet, yielded tender and delicate herbage, and was very favourably spoken of by the late Dr. Gardner, of Ceylon. Several South American writers also spoke highly of the Ichu, a tall undefined grass, on which the llamas and guanacoes of Chili and Peru fattened. The Prangos hay of Upper India was another fodder plant, on which Dr. Royle had already given some information; and a species of Bokhara clover was remarkable for the quantity of herbage which it yielded. Experiments had frequently been made in different quarters; in Jamaica, in Brazil, and in the United States, to cultivate the Chinese tea plant. In its native soil it grew most luxuriantly between the parallels of 25° and 35° N. lat. But above 40° and below 20°, the climate embracing the extremes of heat and cold, would scarcely admit of the full growth and development of the tea plant. Thus the attempts to cultivate the plant for its leaf, in Brazil, in Mauritius, Ceylon, and Pinang, had failed, lying, as those places did, too far within the tropics to offer a climate like Assam, which was situated without them. In the island of Madeira, however, at an elevation of 3,000 feet above the level of the sea, the plant had been cultivated successfully, and the leaf produced was of an excellent quality. The olive-plant could be much more generally diffused through our colonies, forming, as it did, a very important staple production for its fruit and its oil. In the north of Africa, Syria, Sicily, and the south of Spain, it throve well, and had succeeded in Calcutta and Western India. In South Australia it had been successfully introduced. The climate of the Cape Colony, and to a certain extent the character of the soil, were both eminently adapted to the cultivation of the olive. Numerous attempts, at different times, had been made to propagate the olive in various parts of the southern States of America, which had proved unsuccessful. Mr. Simmonds concluded by stating that he had thrown out these few hints, connected with the practical transfer of plants from one quarter to another, in the hope that, combined with a study of the principles that should guide cultivators, so ably laid down by Mr. Masters, they might possibly lead to further investigation and inquiry into the wide field of observation and practical utility thus laid open.

Mr. J. J. **Mechi** had very little to say on this subject, beyond stating that, as a general rule, he had found cereals from cold climates succeed in this country better than those from warm ones. The chairman had kindly furnished him with some from the latter, but they very soon blighted off and died. He believed the cultivation of the Tartarian oat had been attended with as much success as anything that had been attempted in that way. He had listened with great attention to the remarks that had been made that evening, and he was sure that the temperature of the soil had a very considerable effect upon plants, and he attributed the great success of irrigation to the effect it had upon the temperature of the soil. He had found that, in cold weather, putting on spring-water at a temperature of 46°, which was much higher than the temperature of the atmosphere, his crops of rye grass were very much improved and forwarded. Wherever chemical changes take place there was a source of heat, and he had no doubt that the application of manure mixed with water acted more favourably than water alone, owing to the more rapid chemical changes which took place in the sub-soil; and in that way he accounted for the extraordinary difference in the growth of grasses, whether irrigated or dressed with dry manure. He repeated that the effect of the soil upon plants was extraordinary. In soils dressed with marl, some of the indigenous weeds dried out and were not seen again, but a new class of weeds was produced, showing that the soil had considerable effect upon the different productions. It was generally found that bottom-heat had the most extraordinary effect upon all productions. He had a flue running underground in a conservatory, and he found that the camellias and other plants which were influenced by the bottom-heat grew much better than those at a distance from the flue, and where the sub-soil was not influenced by the heat.

Mr. **Masters** begged to ask Mr. Mechi whether he had had any experience with regard to the Peruvian cereals?

Mr. **Mechi** replied that he had seen Peruvian barley grown to great perfection on the banks of the Thames, by Lord Lonsdale; but he did not know the temperature of the climate from which the stock seed was brought—whether from the hills or not.

Mr. **Masters** remarked that Peruvian barley and wheat had been grown at the Botanical Gardens, at Oxford, and turned out to be a complete failure.

Mr. **Mechi** had seen a magnificent crop of black barley grown upon the Essex soil.

The **Chairman** remarked that black barley was extensively grown in the north of India.

Mr. **Mechi**—I have grown large crops of it in Essex.

Mr. G. F. **Wilson**, F.R.S., said,—Mr. Masters had referred to a mode of transporting seeds, preserved from the action of the air by means of a coating of wax. In a note he (Mr. Wilson) received yesterday from Hampshire, from a very zealous and successful cultivator of tropical plants, glycerine was shown to have a remarkable action upon seeds. His friend wrote, "some castor-oil seeds were immersed in glycerine for 10 days; when planted, they germinated very quickly. I then put some of the benee seeds given me last year (some of which my gardener then sowed, but they never came up), into glycerine for 20 days, and I find they are sprouting beautifully; some that were put in water have never appeared. The glycerine must have something to do with even restoring vitality, for I have tried one or two dried up Indian seeds, and they have succeeded also." Mr. Wilson should hardly have expected such very favourable results; but when we remembered the extraordinary power of glycerine as a preservative of both animal and vegetable bodies, he thought it would be well worth while to try some experiments on the transport of seeds in glycerine.

The **Chairman** said, having heard from Mr. Masters some excellent remarks as to the necessity of attending to principles in the introduction of plants, he could mention instances to this day, of the total disregard of such principles in the attempt to introduce various plants indigenous to this country into our colonies. A short time since, a gentleman called upon him to say that he had received a letter from a friend in Singapore—which they were aware was situated very nearly under the equator. This gentleman had been anxious to improve the agriculture of the country, and to give some advantages to the Chinese (who were very good agriculturists), and to the natives in that respect. A list was forwarded of the various plants, &c., which he wished to introduce. They consisted for the most part of the products of the kitchen garden of this country, together with the gooseberry, the apple, and the pear; but not one of them would succeed. The necessity of studying the principles adverted to that evening did not appear to occur to the gentleman who was anxious to introduce those plants. A few days ago he (the chairman) received a printed document from Mr. Jefferies, who had gone out as a well-educated gardener to Madras. He considered himself a finished horticulturist; but he found it impossible to carry into practice in Madras the things he had learned at home; but he found that the principles with which he was acquainted were useful in modifying his practice; and in that way he was enabled to do more than had ever been accomplished before, and he was now growing various plants which he had introduced with good success. Mr. Simmonds had referred to the want of success in the propagation of the cochineal in India. It was a remarkable thing that during the long war in India, a great desire was entertained by the Indian Government—after the cochineal had been introduced into Europe—to introduce it into India, and great exertions were employed to effect that object. As a first step, the plant on which the insect fed was introduced, and an officer at one of the American ports collected the insects, which were said to be of the true sort, for the purposes of commerce. The plan succeeded so far as to result in the production of what was, at first, considered to be very good cochineal; but, upon its being sent to Europe, it was found to be the production of an inferior insect, and that therefore the utmost culture of it would be useless to produce good cochineal; the error was in collecting the wrong species of insect; instead of getting it from Mexico, they brought it from Rio Janeiro. As animal substances had been alluded to, he might mention that the Assam silk-worm had been introduced into the south of France; the insect fed upon the castor-oil plant, and it had been thought that, where that plant flourished, this silk-worm would also flourish—but that did not always follow. In this case, the silk-worm introduced was from Assam, one of the richest and moistest soils, and hottest climates of India, where it flourished, and produced a cheap substitute for silk; but to attempt to introduce that silk-worm into the dry climate of Algeria and the south of France, was one of the most impossible things, and all experiments with regard to it had failed. Last year, H. E. Sir W. Reid, Governor of Malta, had written to the Society, stating that the attempts to introduce this silkworm (*Bombyx Cynthia*) into Italy and Malta had failed, which he should quite have anticipated, because a rich and moist climate was essential to the successful culture of that silkworm; while in Granada they had a different set of phenomena, and there it succeeded very well, propagating very rapidly, and demonstrating that considerations of soil and climate were necessary both with plants and animals in new situations. In the cases on which he had given his opinion, he had found it necessary to pay attention, not only to soil, but also to climate, regarding temperature as well as moisture, which two matters must be attended to in the successful introduction of plants. It was difficult to get the exact climate of different places, but it was desirable to approximate as closely as possible; and in the extremes of cold and heat, even for twice a year, they got an approximation; for they found that a plant able to bear cold might be introduced, whilst others would not bear the same degree of cold. Extremes were sometimes very useful, but it was hardly possible to introduce plants successfully without knowing the extremes, both of heat and cold, to which they would be subjected in their new situation. Another mode of judging whether plants could be successfully introduced, was to notice the vegetation with which they were associated. In the tropics they had the dry climate of the Mediterranean, in which plants not requiring much moisture would always flourish; and if they found plants of the same family in association with those which they wished to introduce, he thought they had another means of judging of the probability of success of their experiment. In illustration of this, he might mention that some experiments were made for the introduction of the cotton plant into India. It was assumed that India was a cotton-producing country as well as America, and it was said that India was suited for the production of cotton. But the species of cotton were different; the American cotton was different from the Indian cotton; and, although both species might grow in the same climate, yet to make them produce their respective crops in profitable proportions, it was necessary that the element of climate should be so apportioned to those plants, that at the required times there might be moist weather and hot and fine weather which was necessary for each. The cotton of America was cultivated with the greatest success in the districts bounding the Gulf of Mexico—in Louisiana, New Orleans, &c., where there was a long clear summer, with occasional showers, with the air loaded with moisture from the Gulf, which kept the plants in a growing state without excess of moisture. In the introduction of this plant into India, in most parts of which they had a cold climate during one portion of the year, a plant of this kind could not grow under such conditions; at the same time, such seasons were adapted to the growth of the fine wheat which Mr. Mechi had mentioned, and also to other European vegetation,—but only for a few months in the year. The cold season was succeeded by a dry season, from March up to June, with an intensity of heat in the soil that would raise a thermometer to 120 or 130 degrees in a few minutes. Therefore it would be impossible to grow American cotton in India till the middle of June, when the rain would come in vast quantities to the roots, which, combined with the heat, would make the plant grow with great rapidity. But the roots of the plant would be very short in that late season. The plant, nevertheless, had abundance of life, and also showed its fibres, and formed the capsules which contained the cotton. Three months after this, the rains suddenly ceased—the soil dried up; where it was of a clayey character it became as hard as brickbats; and this plant, which never formed long roots, was expected to find nourishment! the evaporation from the leaves became excessive, and they dropped off, but still it was able to produce cotton after that. In this consisted the difficulty of introducing American cotton into many parts of India; at the same time they found that where they had the benefit of two monsoons, this plant succeeded. At a place about fifty miles from the sea-side, they had the benefit of two monsoons, and in that latitude American cotton was cultivated successfully, many hundred acres of it growing there, to the displacement of cereals which the inhabitants were slow to give up; and they got better prices for the American cotton than for their own. Again, with regard to the tea plant—the method was, to study the soil, climate, and vegetation that were favourable to the growth of this plant by the imperfect accounts received from travellers, and such as could be gathered from the works of the Jesuits. This, owing to the contradictory statements given, was not easy to do. But, from a study of all the facts, it was found that there was a particular plant unknown to botanists, except in China and the Himalayas, and it was inferred that if the tea plant would grow in association with this plant in China, it would not be difficult to make it grow in the Himalayas, where those other plants grew. The result had been complete success. The tea plant was introduced, which was left three or four years for seed, and now the China tea plant covered a district of 4½° of latitude and 6° of longitude; and the tea was pronounced to be as good as that of China, being manufactured by the aid of people introduced from China. This plant, it should be remarked, was quite distinct from that of Assam, which latter grew to a large size, in contradistinction to the true China tea plant, which was cultivated more as a bush than as a tree. These few remarks, he thought, showed the force of the observations they had heard as to the necessity of studying the principles under which only success could be hoped for in the introduction of plants or animals from one country to another. Nothing was more useful, and there was no subject which was more worthy the attention of the colonist, in order that, for the future, they might avoid the blunders into which others had fallen through an ignorance of the principles so ably inculcated that evening. He concluded, by moving a vote of thanks to Mr. Masters for his able and interesting paper.

A vote of thanks having been unanimously accorded,

Mr. Masters said he was glad that the subject which he had attempted to treat had met with their approbation, and more so, because the correctness of the principles he had enumerated seemed to be admitted by the meeting. He felt that some of the remarks made had been of considerable utility, whilst the observations of Mr. Simmonds formed a valuable addition to the elaborate paper read by that gentleman last session, a paper the importance of which could not be overrated. Whilst speaking of papers upon cognate subjects, he might allude also to that by Mr. Findlay, as supplemental to Mr. Simmonds's, in which it was pointed out that the character of the productions they received was dependent upon the climate itself. This had a close relation to the question which had occupied their attention that evening; because, in attempting to transfer productions from one country to another, regard must be had to the natural capabilities that existed for producing the same materials in the country to which the plant was to be transferred. The remarks of Mr. G. F. Wilson, with regard to glycerine, were very important, as the successful transfer of seeds depended very much upon excluding the air during transmission. Yet, with all precaution, a great quantity of seed sent to other countries had proved useless. He thought glycerine was worthy a trial. Another point, with regard to the transmission of seeds, was that, in many instances, it was to be feared that the seeds sent from this country had been "cooked,"—a large proportion of bad seed was mixed with the good. It was to be hoped that so vile a proceeding would meet with a deserved check. Publicity, as regarded the reports of the botanical gardens, was an important point; still, he did not think it was so much neglected as Mr. Simmonds appeared to imagine, for if that gentleman would look at the botanical periodicals, he would find, year after year, reports of those gardens. Knowing that to grapple successfully with this subject required the experience of the practical agriculturist, and especially a knowledge of colonial agriculture, as well as of vegetable physiology, he felt some unwillingness to undertake the task. At the same time, he should have done the Society great injustice in supposing that the members were incapable of appreciating the difficulties in the case, and the kind manner in which they had given him their thanks showed that he had not been mistaken in his judgment.

The Secretary announced that the Paper to be read on the evening of Wednesday next, the 26th inst., was "On the Manufacture of Soap," by Mr. W. Hawes. On this evening J. K. Brunel, Esq., F.R.S., will preside.

The Secretary also stated that the Annual Ex-

hibition of Specimens, Models, and Drawings of Inventions would be opened on Monday next, and that Members could have cards of admission to distribute to their friends on application at the Society's House.

EXAMINATION OF INSTITUTE CLASSES.

The following letter, with the subjoined reply, are published for the information of the Institutions.

Liverpool Mechanics' Institution,
March 5, 1856.

SIR,—As the condition which requires Candidates for the approaching Examination to attend at the Society's house, excludes from participation in it those Institutions that are desirous of engaging in the competition, but are not so fortunate as to lie near enough to London; and as the scheme contemplates the holding of examinations in the provinces in after years, I wish to inquire if it has been found impracticable to hold local examinations this year, and (if it be not incompatible with the present arrangements) to request, on the part of this Institution, which consists of above 2,200 members and scholars, that its students may be exempted from attendance in London in June, and may be allowed to compete by means of papers to be sent from the Central Committee, and worked in the presence of a local Committee having the confidence of the one in London, in the manner indicated on p. 2 of the Memorandum on this subject, dated 8th Nov. 1854, and under such other conditions for securing equality of competition as it may be thought proper to impose.

It will be seen in the appended statement of numbers now in the Schools of this Institution, that it has large Day Schools attached to it, the pupils of which, I suppose, are eligible as Candidates for Examination.

I am, Sir, your obedient servant,
ASTRUP CARRIS, *Sec.*

P. Le Neve Foster, Esq., Sec. Society of Arts.

DAY SCHOOLS.

Boys	600	
Girls	200	
		800

EVENING CLASSES.

Junior English	37	
Senior ,,	49	
		86
Junior Arithmetic	46	
Senior ,,	98	
		144
Junior Writing	51	
Senior ,,	101	
		152
Elementary Class for Adults		50
Drawing	130	
Mathematics	23	
French	49	
German	6	
Spanish	9	
Dancing	16	
		665
		1465

Society of Arts, Adelphi.
London, 19th March, 1856.

SIR,—I have brought your letter of the 5th inst. under the notice of the Council of the Society of Arts, and I am instructed to say that the Council very much regret they cannot comply with the request of the Managers of the Liverpool Mechanics' Institution to alter the existing arrangements which have been made for holding the examinations at the Society's house, in June next. The shortness of the intervening time would, of itself, be sufficient to deter them from making the change suggested. But, independently of this consideration, the Council of the Society of Arts are of opinion, that an examination conducted solely by means of printed questions and written answers thereto—the examiners and examined being far apart—may be open to grave objection. It would be difficult to enforce, by means of committees variously constituted, and by no means equally zealous, the same precise amount of stringent supervision over the candidates; and without this, the most accurate examination of written answers transmitted from remote distances, would be a fallacious test of the actual relative merits of the Candidates. Besides, no opportunity would thus be given for oral examination, which is an integral element of the Society's Examination Scheme.

I am further instructed to bring under your notice a resolution of the Committee of the Leeds Mechanics' Institution, passed on the 26th ult.

"Resolved—That this Committee cordially approves of the scheme of examination laid down by the Council of the Society of Arts in their *Journal* of Feb. 22, 1856, and recommends that the scheme with its details be communicated to the pupils of the Day and Evening Classes of this Institution, with the offer to pay a sum not exceeding £10 towards the expenses of sending four pupils to London for examination; the eligibility of such pupils to be determined by the Head Master of the School, along with the Committee of the Schools and Classes, and that the Examination do take place on Thursday, May 15th."

It thus appears that it is proposed to hold, in May next, a *preliminary local* examination of such candidates as may desire to compete for the Society's certificates and prizes, and, from them, to select four Candidates to be sent up to the Society's General Examination in June. The Council are of opinion that a principle of the utmost value, and susceptible of the widest development, is involved in this resolution of the Leeds Mechanics' Institution—they believe its general adoption would be fraught with many and signal advantages. A previous local selection would, in many cases, save the examiners the trouble and irksomeness of examining and rejecting candidates entirely unprepared to pass any examination whatever. It would in itself be a distinction for a young man to be selected to represent the Institution of his native town, at the Society of Arts General Examination in London.

The Council believe no difficulty would be found in securing the services of well-qualified persons in the several localities, to conduct with efficiency the preliminary local Examinations.

The pupils of your day schools are eligible for examination.

I am, Sir, your obedient Servant,
(Signed) P. LE NEVE FOSTER, *Sec.*

The Secretary of the Mechanics' Institute,
Liverpool.

SPECIAL PRIZE.

The special prize of £25, or a Gold Medal of that value, offered by the Society for the best Essay "On the Means of Preventing the Nuisance of Smoke arising from Fires and Furnaces," has been awarded by the Council to Mr. Charles Wye Williams.

⁂ This sum forms one of two sums of £25 placed by Benjamin Oliveira, Esq., M.P., at the disposal of the Council for Premiums.

The Society's Silver Medal has been awarded to Mr. Charles Hood, F.R.S., for his essay on the same subject.

Mr. Williams has undertaken to print his essay, and will place in the hands of the Council 2,500 copies, to be presented to the members of the Society and to the Institutions in Union.

Foreign Correspondence.

ECONOMIC MUSEUM.

Brussels, February 26th, 1856.

Sir,—Our Belgian government, in its usual anxiety to promote every measure tending to the improvement of the working classes, has encouraged, and, indeed, has made its own, the project proposed by M. Ed. Ducpetiaux, *Inspecteur des Prisons*, to call together at Brussels, on the 15th of September, 1856, a *Congrès International de Bienfaisance.*

The object of this Congress is to discuss the means of improving the material condition of the working classes. This includes:—

I. Plans, models, materials, and various appliances connected with building.

II. Furniture and household utensils.

III. Clothing and linen.

IV. Food, and the various processes connected with the preparation of food.

V. Tools and instruments for handicraft occupations, both industrial and agricultural.

VI. Worship, physical and moral education, instruction, recreations.

In order to illustrate these subjects, it has been determined that an *Exposition d'Economie Domestique** shall take place at Brussels at the same time.

A committee has been formed, of which I am a member, for the carrying out of this part of the programme.

Our committee naturally applies for assistance to your Society, within whose walls the Great Exhibition of 1851 took its origin, and to one of whose vice-presidents we are indebted for the movement now so satisfactorily progressing in various countries, for establishing public collections of everything that may tend to improve the material existence of the working classes.

The memorandum on this subject, addressed by Mr. Twining to Lord Ebrington, and which I should like to see reprinted in your *Journal*, had, for one of its first results, the exhibition of articles of domestic economy annexed to the Universal Exhibition at Paris, under the especial patronage of their Majesties the Emperor and Empress of the French. Our object is now to form a similar exhibition, on a more complete scale than that could be for want of time.

It is evident that the purpose and requirements of such an exhibition are entirely different from those of universal exhibitions of industry, and I trust, therefore, that British manufacturers, who may feel discouraged at the results of these, will not, by any means, allow themselves to be thereby deterred from joining us in our benevolent endeavours. We require no full assortment of goods, no costly show. We merely ask them to send us a set of patterns of the articles especially suited to the general wants of the million, and that to the value of a very few pounds—in most cases of a few shillings.

The inspection of such a collection of regular trading patterns, with their usual lists of prices, cannot fail to bring back orders to their makers.

Our association for the reform of the Belgian tariff of customs' duties is particularly interested in the success of the Brussels Exhibition of Domestic Economy, the enlightening influence of which on our political economists will be perpetuated by becoming the foundation of a Permanent Economic Museum, and it is contemplated to add to the philanthropic congress, one for the reform of the tariffs of all nations who do not, like your own, enjoy the blessings of free trade.

I remain, Sir, yours truly,
CORR VANDER MAEREN,
Ancien Juge au Tribunal de Commerce de Bruxelles.

Home Correspondence.

REPLY OF MR. WALLIS TO THE REMARKS UPON HIS PAPER ON "RECENT PROGRESS IN DESIGN, AS APPLIED TO MANUFACTURES."

Sir,—As the correspondence, containing many valuable remarks upon my paper on "Recent Progress in Design as applied to Manufactures," was not read at the Meeting on the 12th inst., I had no opportunity to make any comments thereon. I now ask you to allow me to say a few words in reply to certain points which call for attention.,

Several of the writers have, with more or less success discussed the question as to the *causes* of recent progress in design. This was not the subject of my paper, and, therefore, however valuable their contributions in this direction certainly are, they ought not to blame me for not doing that which I did not undertake to do; although causes were incidentally referred to in the course of the paper.

Mr. Aitken has given a disquisition on the *constituents* of glass, and says he differs with me as to the effects of a want of *purity* in the material. On this point I had nothing to say, inasmuch as it had nothing to do with the question in hand. My remarks referred to the necessity for the crystalline *character* of the material being kept in view in the art forms of decorative glass. The qualities of the glass, or its constituents, are not questions of primary importance in *design per se*, but its peculiar characteristics as a transparent material, transmitting light through the forms in which it appears, is, in my opinion, a most important point for consideration. This I endeavoured to illustrate.

Mr. Aitken, too, should always be quite sure that one man has adopted the opinion of another, or, as his remarks infer, obtained his information without acknowledgement from some other source than his own observation, before he compliments him upon his wisdom! It happens, however, that I cannot accept the compliment he pays me in having wisely adopted the intelligent opinion of Mr. Redgrave, expressed in his paper "On Design," since I have never had leisure to read that paper with the attention I could wish, and am totally unconscious that any such remark as that quoted is used therein. I may say, on this point, that for years I have invariably used the argument in public lectures, etc., that quality and weight of material, however excellent the one, or ponderous the other, can never excuse bad art or negligent handicraft, and the effects of a system which looks to bullion value in the precious metals, has been singularly brought home to myself on several occasions. One instance I will give, as it may be useful.

About four years ago I was applied to for a design for a testimonial, to be presented to a gentleman for whom I was known to have very great respect, alike for his public as for his private character. Not having, at that time, paid much attention to the practical points involved in metallic production, it was agreed that myself and the then modelling master of the Birmingham School of Art, (since deceased), should enter into a little friendly competition, and each make a design, to be submitted to a committee for selection, on condition that we were jointly to direct the execution of the work, whichever might be chosen. The drawings were made, mine was much liked;

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* Copies of the programme of the Brussels Economic Exhibition may be had on application to the Secretary of the Society of Arts.

its elegance, refinement, and so forth, commented upon, but there were three points in which it did not meet the wishes of the parties charged with the selection so fully as that of my friendly rival. The first, which was to my mind quite conclusive against it, was that a *cup* was required, that is, a vessel to drink from, whereas I had designed a *vase*, from not having been distinctly informed on that point. The second was, that the symbolism was of too subtle a character to be easily understood by that super-intelligent individual *everybody!* The third, which amused me and disgusted my poor colleague, was, that it was doubtful if the *weight in bullion* decided upon to give the requisite value to the testimonial, could be got into the form and details which I proposed, and therefore that the vase would not *weigh* enough without loading the parts unnecessarily, and then it would not '*look* enough for the money.' The *cup* was therefore very properly selected for execution, not so much, however, I fear, because it was the best design, although it really was the best as a *cup*, but because the ansation was formed of two figures, which, being cast solid, would weigh each about one fourth of the whole bullion weight, and thus leave the body and foot to be executed in shell-work—the requisite number of ounces being made up by cast work in shields, etc. After this, even if I had not seen it long before, it would not have required a paper on design to satisfy me as to the folly of bullion tests of works of art in the precious metals.

Mr. Aitken wishes that some allusion had been made to the very splendid display of French jewellery in the Paris Exhibition, as also to the new method of casting zinc in iron moulds. On these subjects it has been my duty recently to report to the Board of Trade, in a document not yet made public; it therefore would not have been right for me to have anticipated its publication, especially as these points bear more upon French than English progress in design, the latter being my subject.

I think M. Louis Arnoux has not done justice to Messrs. Rickuss and Tofts' adaptation of the tile, etc. process to vases. He should remember that a great number of excellent things, in many branches of industry, are only clever adaptations or revivals of comparatively old processes in a new direction, or in new forms. With regard to Messrs. Pratt's enamelling process being originally Chinese and Indian, I apprehend as much may be said of the finest examples of manufacture in cotton and silk, and probably even in porcelain ! too, or history is strangely at fault. With respect to my supposed neglect of Mr. Minton, in connection with the revival of Majolica and Palissy ware, I doubt if it is in good taste for a public writer to say too much about his personal friends. In this respect I fear I have done an injustice to some of mine, whose works are referred to, but whose names are not given.

I am afraid Mr. Joseph Lockett's good-natured apology for the "willow-pattern" plate, coming after his admirable remarks upon his own special industry, will not do now-a-days; since there is a little too much of the "Oh, it don't matter," and "It is easy to be matched" style of argument in it. Now as good a covering pattern might be obtained by simple mosaic forms in a geometric arrangement, and one, too, which would print quite as easy, and come quite as cheap. Happily, a little more abuse of this monstrous piece of decorative inconsistency will effect its utter repudiation by all persons who *think* about what they buy and use.

Mr. George Jackson's sketch of the rise and progress of a love of art and science in Manchester is a valuable contribution to our knowledge on this subject. I wish he could have recorded as satisfactory a progress in the staple manufactures of that city, as we must acknowledge has taken place in the architecture of the warehouses in which those manufactures are sold.

I think it likely that Mr. James Houldsworth is partly correct in his estimate of recent improvements in the cabinet furniture trade in Manchester. Certainly it shows itself much more there than in most of our large towns. But whilst one sees pagoda-like wardrobes on castors, and bedsteads the type of whose columns, I beg pardon ! posts, might, and I have no doubt did, originate and flourish at Carnac or Thebes, the progress seems of a doubtful character. It is true there might be utility in these Egyptian-like bedsteads, together with toilet suites in which wood and marble of marvellous strength and ponderous thickness play such important parts, since they may beget confidence in their proprietor that, should the roof of his house fall in, he would find a secure refuge under the four-poster or the dressing table amidst the crash of crockery and the wreck of mirrors ! Our furniture wants less wood and better construction,—more taste and less turnery, simply as such,—better carved work, put in more convenient and less obtrusive places; and lastly, greater adaptation to use and less adaptation to useless *show*.

Apologising for occupying so much of your space in the necessary completion of the task I had imposed upon myself,

I am, yours truly,
GEORGE WALLIS.

Birmingham, March, 18, 1856.

CULTIVATION BY STEAM.

Sir,—In reply to yours of the 15th inst., I beg to say that I should have sent my model at the proper time, had I not heard Mr. Ransome state to the Royal President and members of the Society of Arts, on the 5th instant, that the honour of applying steam to the plough was due to Mr. Fowler, he at the same time knowing that it was I who had applied it, and that, whatever Mr. Fowler may now be doing, it is based upon information he has had from me.

I give Mr. Fowler full credit for the construction of the windlasses, pullies, &c., as applied to draining, and am ready to acknowledge that I commenced my experiments after I had read, in the Report on the Exhibition of Implements at the Lincoln meeting of the Royal Agricultural Society, 1854, the following words:—"Surely," was our remark, "this power can be applied *to more general purposes*. We earnestly commend this idea to our engineers and mechanists;" but I must, at the same time, claim for myself, that the windlasses and pullies as applied to ploughing, were constructed for me by Mr. Fowler, according to the instructions given by me to him at the Royal Agricultural Society's meeting at Carlisle, in July 1855, before which time my patent had been taken out, and my plough had been constructed and applied as far as horse-power could test it. I gave the results of my trial in January, by steam, at your meeting held on the 30th of that month; I tried it again the whole of last week, with the best results, and am now receiving letters of congratulation, testifying to me as to its simplicity and efficiency in working.

I have every reason to believe that Mr. Fowler is now constructing a set of ploughs, and have only to say, that I hope, for the good of my brother farmers and the public, he may get a better plough than I have, but I cannot allow him the honour of being the first efficiently in the field.

I am, Sir, yours respectfully,
W. SMITH.

Little Woolstone.

PATENT GRANTS.

Sir,—It would be useful were Mr. Campin to communicate instances in which the intervention of Crown lawyers has been advantageous to patentees. The interference of a Crown lawyer seems mischievous, on account of the delay it occasions, of the expense incurred, and above all on account of the power it gives to an irresponsible agent to forbid the grant of a patent, though he, in many cases, cannot be acquainted with the subject of it.

I am, Sir, very truly yours,
M. S. BENTHAM.

3rd March, 1856.

A CHAPTER ON YERVA DE PARAGUAY.

Sir,—Messrs. Archer and Simmonds, in dealing with an enormous mass of subjects that move our wonder as to their means of aggregating them, deal with one familiar to me as Souchong is to Cockneys. I allude to the article which Mr. Archer says is called *Maté*, while Mr. Simmonds christens it *Yerba Maté*, and both are in error.

Maté is the Indian name for a gourd, or calabash. *Yerba*, or *yerva*, is the Spanish name for herb. *Yerva de Paraguay* is the name known over all South America and in other places, for the leaves and twigs of a tree in Paraguay, yielding a pleasant and exhilarating infusion. The usual mode of preparing the infusion is in a small calabash, or *maté*, with a neck to it, which, cut off, leaves a small hole, the total contents being about the eighth part of a pint.

Yerva is certainly not a proper name for the leaf of a tree, but it possibly may have been originally adopted to distinguish it from the *hoja*, or *coca* leaf, used in Peru for chewing.

To prepare a *maté* is to make an infusion, but it does not necessarily follow that it will be an infusion of *yerba*, which, as an article "dear bought and far fetched," is prized by ladies and well-to-do people. In the pampas of Buenos Ayres, the poor Gauchos invite the traveller to take a *maté cimarron*, *i.e.*, an infusion of wild herbs, analogous to our nettle tea, or balm, or other herb tea. The word *cimarron* is applied to wild men also, and in Drake's voyage he speaks of the Symerons, or fugitive negroes. In the West Indies they called them Maroons. It is probably a corruption from ancient Moorish times, originally Cis-Marrucco, or *next to Morocco*, as the French now call Spain "Africa beyond the Pyrenees." In some cases, where *yerva* exists not, you are asked to take an *Ayua Caliente*, literally, a warm water, in which a bit of orange or lemon peel is steeped.

But these are beggarly appliances, and the true thing is a *maté de yerva*—"the herb," which is held to be a universal luxury, whether prepared in the simple calabash, or in the silver cup, made in imitation thereof, for the wealthy. *Tomar un maté* is to have a good strong cup of the *yerva* infusion. Whether made in the mansion, the cottage, or the wilderness, the process is as follows:—The water is boiled in a copper pot, big-bellied below, and with a long neck and small opening above; a pot such as I verily believe Ishmael first taught the Arabs to make, from traditions of Tubal Cain. The *maté* is then half filled with *yerva*, after the *bombilla* has been placed in position. The *bombilla* is literally a "little pump," that is, a sucking tube, ending in a perforated bulb which performs the office of the perforated diaphragm in our teapot spouts. Some use sugar with the infusion, epicures burnt sugar, and others add a piece of lemon peel, just as we folk at home put a black currant leaf amongst the tea. The boiling water being poured on, the preparation is complete, and the imbiber, holding the *maté* in both hands in cold weather, sucks it dry, with care not to burn his tongue. A second water is poured on, and a second person sucks it, and so on till all the strength is gone, when it is emptied and filled again, till all the company is supplied. It is customary for a *maté* to be sent to the bedside in early morning; and in travelling the first thing the guide does after lighting his morning fire is to prepare a *maté* for his patron. The *yerva* is usually carried in a kidskin bag, the sugar in a second bag, and all goes with the *maté* and the coffee-pot into the *alferjas*, or saddle-bags. Poor people use a reed instead of a silver *bombilla*.

The infusion is highly refreshing taken in the ordinary way, but it is occasionally taken with milk, *maté con leché*. For my own part, whenever milk was to be had, and time served, I invariably used the *yerva*, as we do our tea, with the difference of a bullock's horn, or some such contrivance, supplying the place of a tea-pot. It had all the effect of tea, and I believe it contains the principle of *theine*, as well as does the cocoa-leaf of Upper Peru.

The notion of intoxicating qualities in *yerva* is fanciful. It will affect people of weak nerves as strong tea does, but not otherwise.

Nor is there any reason why it should deteriorate by keeping. Chinese tea is carefully packed in leaf-tin; that of Paraguay is packed in bags of dry hide, in large quantities, and when the bags are open a large quantity is left exposed to the air for a long time.

It is brought to Buenos Ayres, by land or river, 1,200 miles, and sells there at about 4 dollars the arroba of 25lbs.

During the wars of the provinces, when the Dictator Francia hermetically sealed Paraguay, the companion of Humboldt, Bonpland, speculated on planting the trees in the district known as the Missions, on the borders of the Paraguay. Whereupon Francia made a razzia, carried off Bonpland and all his people, and kept them captive till his death, a period of about twenty years. The policy of the despot was to admit all strangers to his capital, and never let them depart.

Matés de yerba are one amongst the four cardinal vices of certain parts of South America. One morning, fresh arrived, and lying in a wattled shed, and just waking, I heard my old guide discoursing *more Sancho Panza* on many things, and amongst others the peculiar qualities of his patron. "This man, my patron," said the varlet, "has actually no vices." "*No bebe, no juega, no toma matés, ni signe tras de las ninas.*" "He neither drinks, nor gambles, nor takes *matés*, nor follows after young ladies. "Think of that, my friend!"

On a villainous spur of the Andes, called, if I recollect, the Cuesta de Acay, it was hard sleeping, while running water was freezing, in the open air, night after night, and harder waking, in the dark, with the Three Mariés (Orion's belt) just rising on the horizon. On such occasions, my guide was wont to lace the *maté* with a little aniseed brandy. One morning, feeling very sleepy, stumbling along in the dark over the refuse of an extinct volcano, it occurred to me to ask old Sancho, "How much water did you put in the *maté?*" "*Ninguna!*" (none) was the reply. So it appeared that in the dark, frosty morning, between sleeping and waking, I had sucked through the *bombilla*,—ere sherry cobblers were known,—about half-a-pint of boiled brandy, flavoured with *yerva*—green tea punch with a vengeance. There was no question of the intoxicating quality of the *yerva* under these conditions.

To conclude. Some years back, M. Hervé, an artist, returning from Buenos Ayres, brought with him some cuts of *yerva*, which was sold retail on Ludgate-hill for about 4s. per lb., and it was much liked by many people. It is probable that, with favourable circumstances, it could be imported here at about 6d. to 9d. per lb., and it would be a very useful addition to our stock of infusion making materials.

I am, yours faithfully,
W. BRIDGES ADAMS.

LAND DRAINAGE.

Sir,—Reading over the important part on Drainage, of Mr. Hoskyns' paper, I concluded to give you my experience of a trip to Scotland, per rail, on the 1st of March. In many parts I observed the natural water-courses choked, which being the case, it is needless to talk of sub-soil drainage. I think, if we were to keep in mind the form of a fish's back-bone, we should not be at a loss how to run our drains best. In many parts I have seen pipes sunk into the ground that I am convinced are being rapidly choked up. Indeed, the run of the drains in the Green Park, Piccadilly, did not please me at all. I have drained land in the tropics by clearing watercourses of timber, etc. I have used the bamboo instead of tiles, in stiff soil containing 90 per cent. of clay, and I regretted often to see nice clean-burnt tiles simply "buried" with but little chance of acting. And I saw much land that, by "surface tapping," would have done much good to the adjacent lands. All this proves that the land surface is not yet efficiently valued in Britain.

Your very obedient servant,
C. M'KENZIE DICK.

23, Newman-street, London, 17 March, 1856.

DECIMAL COINAGE.—THE PENNY.

Sir,—In the Appendix to the second edition of Wingate's Arithmetic, published about 200 years since, is to be found the following table "*of Exchanges of* London *with divers Foreign Cities.*

London doth exchange with	Placentia ……	*Pence* sterl.	64	for	1 crown.
	Lyons. ………	„	64	„	1 crown.
	Rome …………	„	66	„	1 ducat.
	Genoa…………	„	65	„	1 crown.
	Milan ………	„	64¾	„	1 crown.
	Venice ………	„	50	„	1 ducat.
	Florence ……	„	53½	„	1 ducaton.
	Naples ………	„	50	„	1 ducat.
	Lecchia in Callabria ..	„	50	„	1 ducat.
	Barri …………	„	51	„	1 ducat.
	Palermo………	„	57½	„	1 ducat.
	Mesina ………	„	56½	„	1 ducat.
	Antwerp and Colen	£1 sterl.		„	34½ shill. Flem.
	Valentia………	„	57½	„	1 ducat.
	Saragosa………	„	59	„	1 ducat.
	Barselona ……	„	64	„	1 ducat.
	Lixborn………	„	53½	„	1 ducat.
	Bollonia………	„	53½	„	1 ducaton.
	Bergamo………	„	52	„	1 ducaton.
	Frankfort………	„	59½	„	1 florin.
	Genoa* ………	„	83	„	1 crown."

Then follows this remark:—

"*London* exchangeth in the denomination of *pence sterling* with all other countries, *Antwerp* and those neighbouring countries of *Flanders* and *Holland* excepted, with which it exchangeth by the entire *pound* of 20 *shillings English* (or *sterling*)."

Yours obediently,
FREDERIC J. MINASI.

BROOM CORN.

Sir,—The plant which produces this farinaceous seed is extensively cultivated all over Italy, mostly, however, in the middle and northern parts, and is known by the common name of *sagina*, a designation which includes three varieties, but whether they differ botanically, or merely through different modes of cultivation, I cannot say.

The dwarf sagina is sown broadcast at all times in moist districts, but on corn lands as a second crop, after reaping, which is all over by the middle of June. It is only used in its green state as summer fodder for horses and cattle when there is no grass, and is often cut into chaff with straw.

The tall sagina, sometimes eight or ten feet high, is grown only in certain districts, and is that species of which the universal Italian broom is made, all the stems being neatly bound together to form the handle.

The middle size is that which produces the bread corn; and in some districts the only bread used by the inhabitants is made solely from flour derived from the seeds of this plant; very good wholesome bread, however, I commonly made of a mixture of two-thirds wheaten and one-third sagina flour.

In the valley of the *Lago di Bientina*, situated between the Pisan and Lucca hills, the inhabitants subsist entirely upon sagina bread, and though the lake constantly overflows during the wet season, and the land about is very marshy, a position generally most destructive to the teeth in Italy, those who use sagina bread never suffer from decayed teeth. As the plant grows upright, with a single stem, and occupies but little room, the crops per acre are very heavy, and as it flourishes on the cold sides of the Apennines, it does not seem to require much heat in order to bring it to maturity.

HENRY W. REVELEY.

Parkstone, March 5th.

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* Genova(?)

Proceedings of Institutions.

Deptford.—A lecture on "Love" was delivered at the Literary and Mechanics' Institution, by Mr. E. J. Reed, one of the editors of the *London Mechanics' Magazine*, to a numerous audience, on Wednesday evening, March 12. The subject, of delicate interest to all, was eloquently and philosophically discoursed upon by the lecturer, who also read, with much taste and effect, several of the best pieces on the subject from Tennyson, Coleridge, Bailey, and others. The reading of a long scene from Bailey's "Festus" was the only point in the whole of the Lecture which failed in giving entire satisfaction to all present. The lecture was full of beautiful similes, and poetical descriptions; and the members hope, ere long, to enjoy a similar treat from the same gentleman.

Liverpool.—The Annual Meeting of the Members of the Mechanics' Institution took place on Wednesday evening, March 12th. The Secretary read a report, which contained the following particulars:—Receipts during the year, £3,899 1s. 8d.; payments, £3,418 6s. 6d.; balance due to the Treasurer, £570 17s. 9d., being £480 15s. 2d. less than it was the year before. Number of persons connected with the Institution, 927 members and subscribers to the library; 861 pupils in the day schools; and 471 in the evening schools—a total of 2,259. The report noticed the successful working of the several departments of the Institution, enumerated the donations received during the year, and stated that the Institution was completely self-supported, and never more useful or efficient in its operations. After speaking of the girls' school, the report mentioned that advanced female classes, on the plan of the ladies' colleges of London, Edinburgh, and Glasgow, will be opened on the 1st of April, to afford to young ladies who have gone through the course of instruction ordinarily provided in girls' schools, the means of systematically prosecuting their studies in such directions as their taste may incline. The subjects included in the arrangements so far are botany, drawing, elocution; English, French, German, Italian and Latin languages, and literature; geography, geology, mathematics, natural history, physiology, natural philosophy, chemistry, logic, and music. The services of the most capable professors that could be engaged had been secured for these classes, some of which will meet one hour and others two hours a week. The fee for the former will be 12s. 6d., and for the latter 21s. per quarter. Each lady will join such class as she may think proper, and may afterwards obtain a certificate of proficiency in any subject on passing an examination. The directors recommended that "Liverpool Institute and School of Art," should be adopted as the name of the Institution, in lieu of "Mechanics' Institution," which, although once its fit designation, was inexpressive of its widened scope and purposes, and prejudicial to the success of its later features—its day schools. On the adoption of the report being moved, a lengthy discussion took place, on the part relating to the change of name, but ultimately the recommendation was confirmed by a majority of the members, and the change effected. A number of formal resolutions were then passed, and the meeting separated.

SEVENOAKS.—On Thursday evening, the 6th inst., Mr. Tell Topham delivered a second lecture, at the Literary and Scientific Institution, "On the Moral Teaching of Shakspeare." The poet's elevated moral views, his poetic philosophy, his lofty didactic teaching, were illustrated by abundance of incidental reference, and the lecturer's reflections were in harmony with the theme throughout. Probably the finest portion of the lecture was that which brought out the poet's humanising influences. The gentleness and tenderness (notwithstanding their rude lives) displayed by the sons of old *Belisarius* in *Cymbeline*, were referred to, to show that no hostile influences could quench the common feelings of kindliness and compassion. It was represented that Shakspeare, in his delineation of the starved apothecary, desired to arouse sympathy for hopeless poverty tempted into crime by "all-seductive gold." The generous and humane nature given by the poet to the magician *Prospero*, in an age when torture and death awaited the practice of sorcery, was intended (it was said) to soften the popular feeling, which sanctioned the penal barbarities endured by *Prospero's* professional brethren. Numerous other instances of a similar kind were presented, and there was such freshness about the matter, and so much persuasiveness about the manner, that one general feeling of satisfaction pervaded the audience.

MEETINGS FOR THE ENSUING WEEK.

TUES. Meteorological, 7, 1, Dr. Barker, "On the relative value of the Ozonometers of Drs. Schonbein and Moffat, based upon daily observations at Bedford;" 2, Dr. Smallwood, "On the Meteorology of Isle Gum, Canada East."
Med. and Chirurg, 8½.
Zoological, 9.
WED. London Inst., 3, Prof. Rymer Jones, "On Entomology and the General Organisation and Metamorphoses of Insects."
Roy. Soc. Literature, 4½.
Society of Arts, 8, Mr. W. Hawes, "On the Manufacture of Soap."
Microscopical, 8.
THURS. London Inst., 7, Mr. R. E. Grant, "On the Natural History of Extinct Animals."
Numismatic, 7.
FRI. Philological, 8.
SAT. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 13th March, 1856.

Par. No.
46 (1). Burmese War—Return.
89. Barracks—Return.
79. Woods, Forests, and Land Revenues—Abstract Accounts.
83. Bill—Nuisances Removal, &c. (Scotland)
Eastern Papers (Privileges and Reforms in Turkey)—Part 17.
Ecclesiastical Commissioners for England—8th General Report.
Civil Service Commissioners—1st Report and Appendices.

Delivered on 14th March, 1856.

74. Duchy of Lancaster—Account.
87. Fees on Baronetcies, &c.—Return.
90 (1). Civil Services Estimates—Class 1.
92. Masters (Navy)—Nominal Return.
93. Committee of Selection—3rd Report.

Delivered on 15th March, 1856.

90 (2). Civil Services Estimates—Class 2 (a corrected leaf).

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette March* 14th, 1856.]

Dated 5th December, 1855.

2735. Thomas Mara Fell, 49, Frederick-street, Gray's-inn-road—Improved ship's cooking and distilling apparatus, and improvements for the production of fresh water from sea or salt water.

Dated 3rd January, 1856.

21. Edward Vansittart Neale, 4, Russell-place, Fitzroy-square—Improvements in labels.

Dated 8th January, 1856.

57. Claude Louis Pariset, Paris—Improved paste for manufacturing paper, pasteboard, and other similar products.
59. Carlo Pietroni, London-wall—Improvements in printing on cloth and other fabrics. (A communication.)

Dated 21st January, 1856.

157. John Coope Haddan, Cannon-row, Westminster—Improvements in omnibuses and other similar carriages.

Dated 25th January, 1856.

197. Félix Chauchard, Paris—Improvements in the manufacture of paper and pasteboard from vegetable and wood substances.
203. John Beads, Pendleton, near Manchester—Improvements in machinery or apparatus for spinning cotton, wool, or other fibrous substances, where self-acting mules are used.

Dated 4th February, 1856.

295. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in machinery for picking, carding, and combing fibrous substances. (A communication.)

Dated 5th February, 1856.

314. Alexander McDougall, Manchester—Improvements in treating bones, other animal matters, and other substances containing phosphates, for the purpose of obtaining manure and other products.

Dated 7th February, 1856.

332. William Kenworthy, Blackburn—Improvements in self-acting mules.

Dated 15th February, 1856.

391. Edward Oldfield, Adelphi Iron Works, Salford—Improvements in self-acting mules for spinning.
393. Edmund Leach, James Leach, and Edmund Leach, jun., Rochdale—Improvements in machinery or apparatus for preparing, spinning, and drying yarns, and manufacturing the same into cloth.
395. Ebenezer Dobell, Hastings—Improvements in lamp glasses or conductors of light.
397. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in fountain pens. (A communication.)

Dated 16th February, 1856.

399. André Prosper Rochette, Brighouse, near Huddersfield—Improvements in treating soap suds to obtain products therefrom.
401. Frederick Parker, Halve, Trowbridge—Improved apparatus for affording exercise to the human body.
403. Hyam Jacob Hyams, Stanhope-street, Hampstead-road—Improvements in the construction of gas meters.

Dated 18th February, 1856.

404. William Willcocks Sleigh, London—Producing motive power, which he entitles "the hydrostatic motive power engine."
405. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the construction of steam-engines for the purpose of converting the reciprocating motion into a rotary motion, and for operating the slide valves. (A communication.)
407. Henry Hodgkinson, Donegall-street-place, Belfast—Improved machinery or apparatus for bleaching cotton, linen, and other woven or textile fabrics.
409. Moss Defries, Houndsditch—Improvement in supplying oil to the burners of lamps.

Dated 19th February, 1856.

411. William Henry Walenn, 68, Chancery-lane—Improvements in saw teeth. (A communication.)
413. Sylvester Emil Sichel, Bradford—Improvements in apparatus for weaving "ribbed" cloth and bands of "chenille."—A communication.)
415. William Henry Bowers, 4, Singleton-street South, East-road—Improvements in the construction of railways.
417. John Gedge, 4, Wellington-street South, Strand—Improvements in curry-combs. (A communication.)
419. Charles Scott Jackson, Lieut., R.N., 18, Cannon-street, City—Improvement in preserving and disinfecting timber and other substances.
421. William Savery and Henry Arkell, Gloucester—Improvements in apparatus for the passage of water and other fluids.

Dated 20th February, 1856.

425. Thomas Smith and Joseph Gill, Hebden-bridge—Improvements in the mode or method of casing horizontal shafting.
427. James Knowles, Eagley Bank, near Bolton-le-Moors—Improvements in the construction of metallic pistons.
429. John Gedge, 4, Wellington-street South, Strand—Improvements in siphons. (A communication.)
431. John Freer, Rothley, Leicester—Improvements in machines for planting grain and seed, and an improved seed feeder and meter for planting machines.
433. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in steam engines. (A communication.)
435. Jeremiah Clark and James Austin, 13, Moorgate-street—Improvements in apparatus for stoppering or closing bottles, jars, and other similar vessels.
437. Henry Sherwood, Esholt, near Leeds—Improved means of treating the "spun waste" of wool, cotton, silk, flax, hemp, and other fibrous substances, so as to render it suitable for re-working.

438. John Barsham, Kingston-upon Thames—Improvements in the manufacture of cases or packings for bottles and jars.
439. William Oliver Johnston, Broomhill Colliery, Acklington, Northumberland, and John Dixon, High-bridge Works, Newcastle-upon-Tyne—Improvements in cutting and working coal.

Dated 21st February, 1856.

441. Louis Auguste Joyeaux, Marseilles—Improvements in obtaining motive power.
443. William Dawson, Otley—Improvements in machinery or apparatus for cutting paper or other materials.
445. John Gedge, 4, Wellington street-south, Strand—Improvements in looms. (A communication.)
449. Thomas Turner Chatwin, and John Frederick Chatwin, Birmingham—Improvements in buttons.
450. James Diment, Bristol—Improvements in the manufacture of cements.
451. Charles Frederick Dennet, Lansdowne-villas, Kensington-park, and George Pays, 260, Oxford-street—Improvements in cartouche and percussion cap pouches.

Dated 22nd February, 1856.

453. Frederick William Mowbray, Saltaire, near Bradford—Improvements in machinery or apparatus employed in spinning and doubling.
455. William Vincent Wallace, Great Portland-street, and Benjamin Lawrence Sowell, Harrow-road—Improvements in treating tobacco in order to manufacture cigars and other articles for smoking, together with the manufacture of cigars and cheroots from the tobacco so treated. (A communication.)
457. Leonard Bower, Birmingham—Improved machinery for the manufacture of screws.
459. George Toucas, 39, Rue de l'Echiquier, Paris—New metallic alloy.

Dated 23rd February, 1856.

463. David Jones, Green-hill villa, Ragland, Monmouth—Improvements in obtaining and applying motive power.
465. Samuel Walsh and John Henry Brierley, Stannary Works, Halifax—Colouring and graining skins of leather on one side, and japanning them on the other side.
467. Robert Baker Jones, Limerick—Improvements in cooking apparatus.
469. James Warburton, Addingham, near Otley—Improvements in machinery for combing wool, cotton, and other fibres.
471. William Sangster, 75, Cheapside—Improvement in the manufacture of umbrellas and parasols.
473. Charles Brook, jun., Meltham Mills, near Huddersfield, and Joseph Hirst, Wilshaw, near Huddersfield—Improvement in finishing yarns of wool or hair, and in the finishing of woven fabrics or piece goods.

Dated 28th February, 1856.

506. Francis Prime Walker, Manchester—Improvements in machinery for cutting hay, straw, and other vegetable substances.
508. John Smith, Derby—Improvements in water-gauges for steam-boilers, which improvements are also applicable to cocks used for steam and other purposes.
510. Philip Davies Margesson, Woolwich—Improvements in the manufacture of iron from iron ores.
512. John Fowler, jun., Havering, near Romford, and David Greig, Barkingside—Improvements in ploughing and tilling land.
514. Charles Alexandre de Fonbonne, Paris—Improved apparatus for the manufacture of coke and for blasting, also for the production and extraction of illuminating and combustible gas, as well as ammoniacal and bituminous matters, part of such apparatus being applicable to the consumption of smoke.
516. Richard Archibald Brooman, 166, Fleet-street—Improvements in treating bituminous shale, boghead mineral, and other like schistous bodies, in order to obtain various commercial products therefrom. (A communication.)

Dated 29th February, 1856.

518. John Brierley, Blackburn—Improvements in machinery or apparatus for twisting and doubling yarns for mule-banding and similar purposes.
520. John Graham, Aughton, Lancaster—Improved machinery for cleaning and dressing rice and other grain.
522. Foster Connor, Belfast—Improvements in looms for weaving.
524. William Allen Turner, 125, Wood-street, Cheapside—Improvements in the manufacture of elastic tubing.

Dated March 1st, 1856.

526. William Clark, Upper-terrace, Islington—Improvements in cutting or shaping trowsers.
528. John Reading, Birmingham—Improved fastenings for attaching watch keys, seals, watches, lockets, articles of jewellery, and ornamental articles of dress in general to chains, and for securing the catches of brooches.
530. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in looms for weaving. (A communication.)
532. Louis Uytborck, 74, Montagne-de-la-Cour, Brussels—Improvement in locomotive and other tubular boilers, in which steam is generated.
534. Ferdinand Kaselowsky, Bielefeld, Prussia—Improvements in winding yarns and thread of flax and hemp in spinning and twisting machines.
536. William Chapman and John Henry Teager, Ipswich—Improvements in apparatus for cooking animal and vegetable substances, and for heating steam closets.

Dated 3rd March, 1856.

538. Robert Maynard, Whittlesford—Improvements in machinery for cutting and separating agricultural produce.
540. James Wallace, jun., Glasgow—Improvements in bleaching, washing, cleansing, and drying textile fabrics and materials.
542. John Aspinall, Limehouse—Improvements in machinery for curing sugar, or extracting moisture therefrom, applicable to separating liquids from solids.
544. John Venables, Burslem—Improvements in ornamenting articles made of clay and other similar plastic materials.

Dated 4th March, 1856.

546. Edward Poitiers, 12, Malden-terrace, Haverstock-hill—The application of a new material or materials for the manufacture of brushes and for other purposes, and for improvements in the manufacture of street scavengers' and similar brooms or brushes.
548. Richard Archibald Brooman, 166, Fleet-street—Improved fabric suitable for ladies' garments. (A communication.)
552. James Platt, Oldham—Improvements in machinery for spinning, doubling, and winding cotton and other fibrous materials. (A communication.)

Dated 5th March, 1856.

554. Samuel Clegg and John Kay, Padiham, near Burnley—Improvements in machinery or apparatus for warping yarns.
556. William Billington, Great George-street, Westminster—Improved method of treating wooden railway sleepers.
558. Charles Morgan, Cwm Aman, near Llanelly, and Charles Ranken Vickerman, Kilgetty, near Saundersfoot, Pembroke—Improved preparation of fuel, and the application of the same to steam-boiler purposes.

WEEKLY LIST OF PATENTS SEALED.

Sealed March 14th, 1856.

2081. Paul Frederick Wohlgemuth.
2095. Edward Gibbs.
2108. Feridoon Hankey Smith.
2115. William Rothwell Lomax.
2152. Peter Armand le Comte de Fontaine-moreau.
2155. Francis Xavier Poignand.
2190. George Curling Hope.
2232. François Charles Lepage.
2283. William Lyall.
2309. William Cotton.
2374. Alfred Vincent Newton.
2375. James Smith.
2396. Joseph Charles Frederick, Baron de Kleinsorgen.
2572. Alfred Vincent Newton.
2639. Charles May and Paul Prince.
2837. Agnes Wallace and John Wallace.
2921. Frank Clarke Hills.
2929. Nicholas Douglass.
2931. James Edgar Cook.
11. George Hamilton.
31. Charles Hart.
36. Edward Hammond Bentall
148. Alfred Dawson.

Sealed March 18th, 1856.

2112. Louis Cornides.
2121. Asa Lees and John Clegg.
2125. William Pollitt and James Eastwood.
2127. David Chalmers.
2140. Charles Frederick Whitworth.
2146. John Norbury.
2163. Richard Locke Johnson.
2174. William Neufville Martin.
2179. William Illingworth.
2184. William Kempe.
2213. George Frederick Gruet.
2226. Jean Daniel Pfeiffer.
2243. William Rothera.
2520. John Olive and William Olive.
2717. Frederick Walton.
2912. Thomas Cowburn and George Walker Muir.
12. Harvey Lewis Sellers, M.D. and John Littler Talbott.
85. Alfred Vincent Newton.

Patents on which the Third Year's Stamp Duty has been Paid.

March 11th.

696. John Stather.

March 12th.

630. Robert Christopher Witty.
672. George Rock Lucas.

March 13th.

645. François Durand.
660. George Johnson, M.D.
718. William Keates.

March 14th.

711. Antoine François Jean Claudet.
793. William Edward Newton

March 15th.

652. William Malins.
659. William Blinkhorn.
665. Paul Cameron.
669. Richard Archibald Brooman.
670. Auguste Edouard Loradoux Bellford.
674. Henry William Harman.
2449. Thomas Stainton.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3818	March 15.	Boot	C. and J. Clark	Street, near Glastonbury.
3819	March 18.	Synoptical Needle Case	Joseph Morris and Sons	Astwood Bank, near Redditch.

Journal of the Society of Arts.

FRIDAY, MARCH 28, 1856.

FIFTEENTH ORDINARY MEETING.

Wednesday, March 26th, 1856.

The Fifteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 26th inst., J. K. Brunel, Esq., F.R.S., in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Aubert, John Lewis.
Cooper, William.
Coutts, J. S.
Faulkner, John, jun.
Jackson, William Henry.
Marchant, W.
Tuson, Richard V.
Winter, James, jun.

The following Institution has been taken into Union since the last announcement:—

411. Sidmouth, Institution.

The paper read was

ON THE MANUFACTURE OF SOAP.

By William Hawes.

I am aware that the subject of the paper I have undertaken to read this evening cannot be so attractive as many which have preceded it during the session.

I have no new chemical discoveries to report or to describe. I cannot entertain you by the exhibition of beautiful specimens of manufacture, displaying the skill of the workman, the ingenuity of the master, or the perseverance of the capitalist; nor can I startle you by showing the vast progress of a trade from which the improved condition of the people may be inferred; but, on the contrary, I shall have to show how a manufacture, which is essentially necessary to the health and comfort of all, and more especially to that of the great mass of our labouring population, and the use of a larger or smaller quantity of which may be taken as almost conclusive evidence of the position of a people in the scale of civilisation—has been checked; how every attempt at its improvement has been thwarted; how the cost of the soap produced has been increased; how, in fact, by the odious interference of the excise, a chemical process has remained with scarcely an improvement for the last 200 years.

Before I describe the manufacture, I will briefly notice the little we know of the history of soap-making.

Soft soap appears to have been in general use from time immemorial. It was made from fish oil and the ley from wood-ashes, boiled together till they were of the consistency of honey, but we hear little or nothing of hard soap, from its introduction to this country, early in the 16th century, until 1622, when letters-patent were granted for twenty-one years to various titled persons for its manufacture with barilla, and for the manufacture of soft soap without the use of fire "by sundry motions, and not by boiling thereof." These patents were not worked; but in 1631 another patent was granted for fourteen years to Sir Wm. Russell, Sir Richard Brooke, and others, with a proviso that certain privileges might be disposed of by his Majesty Charles I.

In 1632 a third patent was granted, for a new mode of making white soap, whereby it should be cheaper and better than the soap then in use, and on condition that the patentees would pay to his Majesty £4 per ton upon every ton of soap sold, and that they should be incorporated by the name of the Governor, Assistants, and Fellows of the Society of Soap-makers of Westminster. Their Charter gave them the exclusive right to make soap by any of the ways then known, or by any new ways—to search for soap made by others and to destroy it, &c.

The corporation agreed to make 5,000 tons of white soap yearly, and were to pay, after the first year, £4 per ton to the king, and not to sell the soap at above 3d. per lb.

This corporation adopted various means to prove that their white soap was superior in quality to any other soap then made, and obtained from Sir Robert Ducie, the then Lord Mayor of London, a certificate to the effect that, after trials in his own house, he found the soap made by the corporation to be better than that made by the old soap-makers.

The public were not, however, satisfied with this decision, and the low price of fish oil enabled the old makers successfully to maintain their trade in soft soap.

To stop this competition, the Westminster corporation of soap-makers obtained a proclamation from the king, prohibiting the use of fish oil in soap, and also the sale of any soap not tryed and approved by the assayers of the soapers of Westminster.

This being also ineffectual in stopping the trade, an information was laid in the Star Chamber, Nov. 22, 1632, against sixteen soap-makers in London, for opposing the letters patent of the said corporation, for using fish oil, and for selling unmarked soap.

The soap-makers pleaded in opposition to this information, that they were all free men of London, that the patent was a monopoly, and contrary to the laws of the kingdom. This plea was referred to the judges, who, after many hearings, which occupied from Nov. 1632, to May 1633, condemned all the defendants to be imprisoned during his Majesty's pleasure—to be disabled from using their trades, and to be fined, some £1,500, some £1,000, and the least £500; all were committed to Newgate, where two died; thirteen were confined for forty weeks, and one nearly twelve months; nor were the fourteen survivors released till they had given bond not to make soap again. The fines were all levied, and extents, when required, were issued against their property for the amount of the penalty.

These proceedings were followed by a general decree in the Star Chamber, August, 1633, whereby the monopoly of the Corporation was confirmed and surrounded by more severe restrictions. The price of soap was fixed at 3d. per lb., with penalties against those who exceeded this price as persons who "oppresseth the King's subjects," and the manufacture was confined within a distance of one mile from London and Bristol. So strong, however, was the dislike of the soap manufactured by the Corporation, that women in the streets gave away printed statements, showing "how the soap spoiled and burnt the linen, and fretted the hands of the washers."

In consequence of this opposition it was ordered by the Council that it should be referred to the Lord Mayor, Sir Ralph Freeman, and others, to inquire into the quality of this soap. Above four-score witnesses were examined—countesses, viscountesses, ladies, and common laundresses, who all certified to its inferiority, and a proclamation was therefore published, ordering the Lord Lieutenant and Sheriffs of London to seize and sequestrate all the soap made by the soap-makers of London.

Under this proclamation attachments were issued against various makers, and the pans, vats, and utensils of above 40 were destroyed.

Other proclamations were issued from time to time, regulating the price and mode of manufacturing soap, and imposing heavy penalties against offenders.

The importation of foreign soap was prohibited, and a warrant dormant was opened to apprehend such persons as the Governor of the Corporation of Soapers in Westminster should nominate. In justification of these oppressive measures it was alleged that the Corporation had in two years spent £6,000 in law, £115,000 in general expenses, that their yearly charges were £8427, and still they could not sell soap. So determined, however, were the people not to purchase their soap, that in November, 1634, the Corporation were obliged to engage one of the old soap-makers to manufacture for them, notwithstanding his bond to the contrary; and to such an extent did he succeed, that for many days together, in February, March, and April, 1635, they sold £500 worth daily. This led to further prosecutions, fines, and imprisonments, which ended in 1636 by the Corporation entering into a new covenant with the King; whereby they agreed to make 5,000 tons of good soft soap yearly, paying £6 per ton thereon to the King, and to sell at 3d. per lb. This arrangement was not more successful than its predecessors, and shortly afterwards the patentees of Westminster obtained from his Majesty a grant of £40,000 for surrendering their patent, and £3,000 more for charges of their houses, to be paid by the old soapmakers of London, who also agreed to take their materials, valued at £20,000, and all this only to "have their old trade back again." The King then incorporated the soapmakers of London, and they agreed to pay £8 per ton to his Majesty, without raising the price to the public, and which tax, in three years, produced the large sum of £90,000.

In 1646 the makers petitioned the House of Commons to remove the duty on soap, and to substitute for it a duty on the raw materials. In 1650 a duty having been placed upon the raw materials, and that upon soap retained, we find it declared, in a petition to the House, that the trade "has been driven into holes and corners in all parts of the kingdom, and that the duty upon soap made in London had fallen from £4,658 in 1643-4, to £2,108 in 1649-50." From this time to the 10th of Anne, we know nothing of the progress of the trade. In that year the excise on soap was firmly established, first at 1d. per lb., then in two years advanced to 1½d. per lb., at which rate it remained till 1783, when it was raised to 2½d., and in 1816 it was again increased to 3d. per lb., or £28 per ton, each advance of duty bringing with it additional restrictions upon the manufacturer, under the erroneous idea that the security of the revenue would be thereby increased. It was, however, clearly proved to the Chancellor of the Exchequer in 1833, that illicit trade was systematically increasing, and the duty derived from soap as a consequence decreasing, facts which induced Lord Althorpe to reduce it to 1½d. per lb., at which rate it remained until it was finally repealed in 1852.

Before proceeding with my subject, it may be useful to consider for a moment the effect of the Excise regulations upon this trade. The manufacturer was not allowed to make his soap as he thought best; but was obliged to make it according to rules prescribed in Acts of Parliament passed in the reign of Queen Anne. He was required, in the 19th century, to adopt the processes used in the 17th century. From a given quantity of the raw materials, weighed by the Excise, he was obliged to produce, and pay duty upon—whether produced or not—a fixed quantity of soap, notwithstanding the ever-varying quality of such materials. Deviations from fixed rules involved heavy penalties; the omission, for instance, of a notice to light a fire twelve hours before it was required, subjected him to a penalty of £20, and the omission of a notice to put materials into a copper, to a penalty of £100, and so on.

From these sources of annoyance—from these fetters upon the exercise of skill and knowledge, the manufacturer is now, and it is to be hoped for ever, relieved, and this last remnant of that debasing system of taxation, which taxed our air, our light, and our cleanliness—by which ignorance and fraud were tempted, by the facility of evading high duties, into rivalry with intelligence and honesty, and under which the exciseman became a judge whether an improvement, desired by the manufacturer, should be introduced or rejected, is entirely abolished.

One after another the candle duty, the window tax, and the soap duty, have fallen before the intelligence of modern times, and light, air, and cleanliness are no longer stinted in quantity, or enhanced in price, by the interference of the Excise.

I think it of so much importance that the injury inflicted upon trade by an Excise should be thoroughly appreciated, that I will venture to place some of the statistics of the trade before you, that you may compare the activity and enterprise which have so distinguished the manufacture of candles and alkali since the repeal of the Excise duties on salt and candles in 1823 and 1831, with the state of the soap trade during the same period. The time to which my figures refer is so distant, and the state of the trade since the removal of the duty is so changed, that no injury can arise to any one from the exposure of the miserable state to which it was then reduced.

The quantity of soap upon which duty was paid, shewed a consumption per head of the population, per annum, of 5·9lb. in 1833, the duty being 3d. per lb., and 7·14lbs. in 1843, the duty being then but 1½d. per lb., whilst it was ascertained, on good authority, and after most careful enquiry, that the quantity used in many large workhouses was as the rate of 7¾lbs. per head per annum; that convicts were allowed 11½lbs. per head per annum; that the labouring classes used above 9lbs. per head per annum, and the classes above them from 12lbs. to 24lbs. per head per annum.

It was also shown that in Jersey, where there was no duty on soap, the quantity used was 13·1 lbs. per head per annum; in the Isle of Man, it was 8·68 lbs.; in Jamaica, including the negro population, it was 4·80 lbs.; and in Ireland, 4·92 lbs. per head per annum; whilst, then, it was clearly ascertained that not less than 10 lbs. was used by each person per annum in England and Scotland, —the duty was collected in 1833 upon 5·9 lbs., and in 1843 upon 7·14 lbs. for each person.

Was it possible for any trader, working under such a system, to avoid one of two dilemmas, either to evade the duty in self-defence, or to withdraw from such a competition.

Now, let us trace the actual result of this state of things upon the trade.

In 1833, there were in England 262 licensed soapmakers. Between 1833 and 1848, licenses were taken out by 344 new makers; making a total of 606 makers in business in 1833, and commencing soap-making between 1833 and 1848. Of these 606, only 157 were in business in 1848, 449 having failed or left the trade in the fifteen years, and of the 157 remaining in 1848, not more than 70 were in business in 1833, out of the 262 then at work, and of these 70, several had failed, but continued their works during this period of 15 years.

Such, then, was the state of a manufacture employing from £1,000,000 to £1,500,000 of capital, but carried on under the fostering care of the Excise, whilst in the same period alkali-making, which did not exist in this country as a branch of manufacture till some years after the repeal of the salt duty in 1823, and the candle trade, to which, at that time, neither machinery nor science had been applied, have both expanded and become important national manufactures, and have rewarded almost everyone who has brought science or capital to bear upon them.

I will now proceed to describe the manufacture of soap. Soap is of two kinds, hard and soft. Soft, the elder manufacture, is made from fish oil, a portion of tallow, and potash; hard, from almost any fatty matter, whether animal or vegetable, in combination with soda.

Soft soap was in general use in all parts of the world long before hard soap was known. No doubt, from the easy combination of the ley obtained from natron in eastern countries, and from wood ashes in more northern climates, with oil or other fatty matter. Boiling these together, and evaporating off the excess of water, either by fire or by exposing the mixture to the heat of the sun, would produce a soft unctuous mass, or soft soap.

Our soft soap of commerce is a simple mixture of oil, vegetable or animal, and a given quantity of tallow, with a ley of caustic potash. No more alkali is used than is required to form the soap, which being added to the oil and tallow in a ley of light specific gravity, is gradually concentrated till the soap attains the required consistency, when it is taken from the copper, and run into barrels for sale. In a short time it assumes the speckled appearance of the sample on the table, which speckling arises from the gradual crystallisation and separation of the margarate of potash from the oil soap.

The regularity of this crystallisation is the best evidence of the perfect manufacture of the soap. No glycerine, if it be produced, is removed from the copper during the process of making soft soap. If produced—and to this I shall refer hereafter—it is left in the soap. The produce of soft soap from a ton of oil and tallow is much greater than from the same materials if made into hard soap; it is, therefore, the cheapest soap, and where it can be advantageously used, as in washing wool or cloth, is, no doubt, the most economical. Its smell and its consistency prevent its general use for household purposes.

Hard soap, as I have already stated, is made from any animal or vegetable, fat or oil. Specimens of the various kinds of soap, supplied to me by my friend Mr. Soames, are on the table.

The white and mottled soaps of commerce are distinguished from yellow soap by the absence of resin; in other respects, though the process of finishing differs, they are alike, each 100 parts, when of good quality, containing about 63 of fatty acid, 6.5 of alkali, and 30.5 of water, or, in other words, one atom of soap consists of 17 atoms of water, one atom of grease, and one of alkali: but I am sorry to say that the rage for cheap soap, induced by its high price, the consequence of a high duty, has led to the mechanical admixture of large quantities of water with yellow soap, the practical effect of which is to lower the money price per lb., but to lower the quality of the lb. still more, and besides the injury to the quality, the buyer has to pay for mixing the water with the soap, and for its cartage to his house, a very dear way of obtaining that which any pump or water company will supply almost for nothing.

The process of hard soap-making is not so simple as that of soft soap. A solution of nearly caustic soda is added to the fatty matter. These are boiled together just sufficiently to allow gradual combination of the alkali with the grease, when the excess of ley is separated from the imperfect soap and is run off into reservoirs below; another portion of alkali is then added, the boiling is continued till the soap is chemically perfect though not finished commercially, and here begin the processes by which the special character is given to the different descriptions of soap.

Mottled soap, perhaps the most perfect of all, is boiled into a curd on a strong alkaline ley, and, a few hours after the boiling has ceased, is taken direct from the copper to the frame or mould, from which, when cold, it is cut up into bars or cakes for sale.

During the process of cooling mottled soap, a curious change takes place.

It is put into the frame of the consistency of thick paste. In a short time there is a considerable evolution of heat—the thick soap becomes almost fluid—the excess of alkali mechanically held between the grains of the curd falls through it to the bottom of the frame, leaving the stain you see in the slab of soap on the table. At this moment the crystallisation of the soap begins, and just as this is perfect or imperfect, so is the quality good, and the mottling regular and handsome, varying very little from the top to the bottom of a frame 10 or 12 feet in height, and containing from 20 to 40 cwt. of soap. No extraneous matter can be added to mottled soap without destroying the regularity of the mottling, and this soap is therefore nearly always of one uniform quality, and the most economical for household purposes.

The clarifying process, which, with mottled soap, takes place in the frame, is performed upon yellow soap in the copper. After the soap is made, and the great excess of strong ley used for finishing the soap is run off, a quantity of weak ley is added, and mixed thoroughly with the soap by gentle boiling. The soap is then allowed to cool gradually, and in two or three days this weak ley, having a little higher specific gravity than the soap, subsides, carrying with it all extraneous matter, and leaving the soap floating upon it, which is then skimmed off and put into the frame to harden. It is when taken from the copper, and before being put into the frame that water, or a very weak alkaline ley, or a solution of sulphate of soda is added to reduce the price, either one or the other being merely mechanically mixed with the soap.

White, or curd soap, differs from both mottled and yellow. It is made from the finest tallow only, and boiled to a much thicker consistency, upon a stronger alkaline ley, than the other soaps, and before being put into the frame to cool, requires crutching or stirring about in an intermediate vessel, to break and mix the curd, so that, when cool, it shall be uniform and homogeneous. No clarifying process is required, nothing but the best and cleanest materials being used for this soap.

Fancy or perfumed soaps are made by the addition of perfumes to yellow or white soap, either when taken from the copper, and before being put into the frame, or by re-melting the perfect soap and adding the perfumes to it. In this state it is moulded into any form, or stamped with any device the perfumer requires for his trade.

Having manufactured the soap, I will now devote a few words to its uses.

I must assume you are all familiar with its ordinary application as a detergent, but as little thought is often bestowed upon the causes of effects which are of daily occurrence, I will point out how and why a compound of grease and alkali should produce such beneficial results.

In washing, two desiderata are required; one to cleanse, the other to cleanse without injury to the most delicate fabric.

Alkali alone will cleanse, but it will not wash. If used alone, a little carelessness as to the quantity used, and fine linen would be destroyed, and a very unpleasant effect produced upon our hands and faces; but if combined with fatty matter, you have it so minutely divided and so small a quantity in action at once, that neither the most delicate fabric nor the most beautiful complexion can be injured.

In this state you may rub it into materials of the finest texture without any fear of injury from the alkali itself, or from the mechanical action of washing; in fact, one portion of alkali, united with grease, totally changed in its character, becomes the medium whereby another portion of alkali can be so thoroughly incorporated with the articles to be washed, as to ensure the combination with, and the removal of all impurities by which they are soiled. Whilst, then, the pure alkali cleanses, that combined with the grease forms an anti-attrition, which preserves the articles washed from injury.

A striking contrast to this mode of washing is seen abroad, where but little soap is used, and that little is forced into the linen by beaters, to its serious injury, washing generally taking place by the river side, out of doors.

This mode of washing has been adopted not only to economise the use of soap, but on account of the inability of the poorer classes to obtain cheap fuel and the other utensils necessary for washing in warm water.

Having thus described in general terms the manufacture of soap and its use, I will next refer to the few improvements which have been effected in the apparatus and mode of working. The most important, and the first in date, was that of boiling by steam, which was successfully used in the manufactory with which I was connected, in 1825. The steam was applied by means of a coil of pipes placed at the bottom of the copper, when simple concentration was required, or was blown into the copper through a perforated coil, when mechanical action was necessary, or both were used together, most beneficially, thereby securing the most rapid and most perfect mixture of the materials—every portion of grease being thereby brought into contact with the alkaline solution. The process, by this combination, was more rapid and more perfect than could be accomplished by an open fire, acting directly upon the bottom of the copper, saving, at the same time, great waste in broken pans, leakages, &c.

The next improvement was the iron frame or mould in which the soap is cooled. Mr. Doe, an iron-founder, in London, first introduced it, but it was only after much trouble that the Excise allowed it to be used.

These are the only improvements in the apparatus for making, and in the mode of manufacturing soap, since the reign of Queen Anne. With these exceptions, the manufacturer has not been allowed to use any other apparatus, or to vary the process described in the Excise Acts of 1710; and so recently as 1835 it was with great difficulty, and only after the strong recommendations of the Commissioners of Excise inquiry, that manufacturers, even if they asked for permission so to do from the authorities, were allowed to make experiments; but this privilege, unwillingly granted, was clogged with so many forms, that it was practically useless.

Indeed, it may be asserted with perfect truth, that until the present Chairman of Inland Revenue became the Chairman of the late Excise Board, every obstacle that a vicious system of excise could offer to improvements was rigidly enforced.

This system was gradually relaxed; Mr. Wood listened to the complaints of the trade; more intelligent officers were appointed; and many vexatious and useless regulations were repealed or modified; but it was not in his power to prevent illicit trade, in competition with which no respectable maker could be really successful, nor could he afford to waste his time or money in making improvements which could be carried by the exciseman to his neighbour and rival.

But the injury to the trade did not stop here. It converted every intelligent and active manufacturer, first into a stationary machine, on account of the difficulties which surrounded him if he attempted the most trifling change either in process or apparatus, and ended by making him an opponent of improvement.

Every extension of his Excise-regulation plant—every pound of capital invested in it, pledged him deeper and deeper to the old system, till at last he was compelled to stand still himself; and then, to prevent others from improving, he became an active supporter of the Excise, as the best mode of securing his property from destruction.

Now, with such influences at work for two hundred years—for from the first moment when soap could be called a manufacture, it had been under the Excise—can you be surprised that while on all sides of it old manufactures have been improved, and new ones have risen up, that this has stood still. Unlucky indeed may any one think himself who has spent the early years of his life, bound hand and foot to that heavy broad-wheeled waggon, moving on its dull and monotonous way, uninfluenced by anything around it, and gaining no experience by the past, which was driven by a board of gentlemen styled the Honourable the Commissioners of Excise.

I have thought it necessary to dwell at some length upon this part of my subject, because, when new taxes are under consideration, and a class of politicians is advocating a return to the system of indirect taxation, it is of great importance that the injury the excise inflicted upon all manufactures under its surveillance—how their progress was checked—the law evaded—and perjury encouraged for 150 years—should never be forgotten.

Having thus rapidly described the process of soap-making, I will now direct attention to the materials used in its manufacture.—The first in importance is tallow, under which term I include every description of animal and vegetable, fat and oil. Until within the last forty years hard soap was almost exclusively made from foreign and English tallow, with a small quantity of fish oil for the commonest soap and resin. Nineteen-twentieths of the foreign tallow was imported from Russia.

Gradually, however, a great change has taken place, and the importation of palm oil, which had then scarcely commenced, has steadily increased till it now amounts to nearly 40,000 tons per annum, the greater part of which is used in soap, though the proportion required for candles is increasing daily. This supply of a cheap oil, applicable to the manufacture of candles, as well as to that of soap, has been attended with most interesting results. It has helped, with the annually increasing use of gas in private houses, to make this country nearly independent of Russia for the supply of the raw materials for soap and candles, but it has done more than this; it has promoted the success of the efforts this country has so persistently and honourably made, to suppress slavery and the slave trade.

This trade in palm oil, the produce of that part of the western coast of Africa lying between 5° north and 2° or 3° south of the equator, from whence the greatest number of slaves was drawn, has done much to improve the condition of the negroes, by introducing to them a yearly increasing quantity of English manufactures. It has provided the chief with an income arising from the employment of his people, greater than he could realise by their sale, and in this instance, as in most others, we find that the productive power of nature, when properly used, is a more practical teacher of sound principles—a more certain civiliser of barbarian tribes, and a more effectual weapon wherewith to combat heathen ignorance, than coercive laws, or the persuasion of churchmen to whatsoever church or creed they belong.

A curious illustration of the absurdity of the Excise interference is shown in the progress of the use of palm oil.

Its red colour, which is no doubt familiar to all, limited its use to yellow soap. Several processes were invented to remove this colour, so that the oil might be used for other soaps. That most commonly in use at the time to which I refer was mixing nitric acid with the melted oil, by which its bright red colour was changed to a brownish red.

By experiment we found that a much cheaper and better result could be attained by simply raising the temperature of the oil to 400 deg., thereby avoiding the use of any chemical agent whatever.

The question then arose, how could this be done without the knowledge of the Excise, who of course had access to the place when the oil was decoloured, and could be present whilst the process was in progress; and it was accomplished by our daily going through the absurd ceremony of carrying from the laboratory, first, a bottle of coloured water, and afterwards a coloured bottle only, which was supposed to contain the ingredients by which the colour was removed.

Under this simple disguise we decoloured palm oil by a process unknown to any other maker for nearly ten years, when it was discovered and made public by our gas-maker, who found, whilst making his gas from palm oil, that the oil which leaked from a joint in the feed-pipe, close to the heated retort, was white instead of red.

I have said this oil is as useful in candle-making as in soap-making, but it is right to add, that it is only within the last few years that this desirable result has been attained, after long and arduous experiments, and the application of much scientific knowledge by my friends the managers of the candle company.

And here let me for a moment call your attention to what was not, I think, sufficiently dwelt upon by my friend Mr. Wilson in his interesting paper upon candle-making, I mean the effect of the repeal of the candle duty in 1831. Had that duty remained on candles till 1852, as the duty did upon soap, it is not too much to say that the improvements in candles and candle-lamps of

Messrs. Palmer, and the splendid works at Vauxhall would not have existed, and as in past times, we should now, where gas could not be used, or was not to be obtained, be reading and writing by the dim, flickering, and fluctuating light of a dip or a mould, ever wanting snuffing, and spreading dirt and its annoyances around it.

I hope to show an equally important future is in store for the soap trade, so soon as its freedom from the Excise has had time to induce capital, science, practical knowledge and industry united, under a new law of partnership, to bring their powerful influence to bear upon it.

The other raw material used in soap is alkali, soda for hard soap, potash for soft soap. Here, again, we see the effect of the repeal of an Excise duty upon price and quality.

Alkali, during the existence of the salt duty, cost from £8 to £12 per ton of soap. The price fluctuated as the crop of seaweed in Spain and Teneriffe was good or bad, and, excepting the small quantity obtained from kelp, all the alkali used was imported from foreign countries.

So long as we derived our alkali from barilla and kelp, the high duty on soap, except as it affected improvements, was of little consequence to the fair trader, for independently of the capital required for the purchase of so costly an article, its bulky form was a better check upon illicit trade than all the regulations of the Excise. For every five tons of soap made, the maker had to cart into his premises nearly two tons of barilla and kelp, and to carry away, mixed with lime, nearly the same quantity of waste, and, if he had used kelp only, nearly twice as much. The appearance of this waste was so peculiar, that no one could doubt that where a heap of it was seen, soap making was near. The alkali for a ton of soap, which then cost from £8 to £12, is now, in consequence of the repeal of the salt duty, reduced to £2 per ton of soap. It is supplied to the soapmaker in a very pure state, requiring only to be deprived of its carbonic acid before it is ready for use.

The effect of the repeal of the salt duty upon the soap trade, important as it has been, was quite secondary to its effect upon glass-making, and in establishing a large trade for alkali, in lieu of the small trade in barilla. For instance, we imported in each of the five years from 1830 to 1834, 12,000 tons of barilla, worth about £200,000, whereas I find from a valuable paper of the statistics of the alkali trade, prepared by my friend, Mr. Alhusen, of Newcastle-on-Tyne, that we now export 50,000 tons of alkali, and crystals of soda annually of the value of £423,000, and that the manufacture is estimated to employ between 6,000 and 7,000 men, about 370,000 tons of shipping, and that about 500,000 tons of coals, and 140,000 tons of salt are annually consumed to produce a better alkali at one-fifth the price at which we obtained it when the excise was on salt.

It must not be supposed, however, that because few improvements have been made in the process or in the utensils used in the manufacture of soap, it has been for want of so called inventions, or for want of that will o'the wisp of inventors, patents, for their improvement.

I am afraid to say how many patents have been taken out for this object; how many persons, tempted and deluded by the imaginary profits of a monopoly, have employed valuable time and energy, and spent much money to no purpose.

Failure has invariably followed such attempts, because the fear a projector entertains lest some one should gather his golden apple when just within his grasp, prevents his seeking information and advice, from those able to afford it, as to what is wanted—what is known—what has been tried and failed, and what is likely to succeed. I feel satisfied although in this society I know my opinions are those of a small minority, that the patent laws, whether viewed from the inventor's point of view, or from that of the public of whom he asks a monopoly, are alike injurious to all, and that both patentees and the public—except in a few rare cases—are injured by the protection supposed to be afforded to the one, and by the enhanced price, consequent upon the monopoly granted to the other, and because, instead of relying upon their own knowledge and skill for success, patentees prefer placing their trust in the protection of restrictive laws, which the whole experience of legislation proves to be a snare and a delusion. Indeed, I feel sure, could we ascertain who found the capital for patents, we should be surprised how exclusively it had been provided by persons out of business, unacquainted with the real state of the manufacture to which they related, and who were misled by glowing pictures of large gains to be *secured* by a monopoly, to be purchased for a trifle.

The only patent relating to the manufacture of soap which appeared likely to succeed and to lead to a practical result, was for combining the materials by mechanical means without the aid of fire, the object being to avoid the formation of glycerine, which brings me to the last division, though not the least important division of my subject, for it is in this direction, I look for the first great result, from the removal of the supervision of the trade by the Excise.

I feel satisfied, however, that much inquiry, and a series of accurate experiments on a large scale, must be devoted to this subject, before the success I confidently look for can be achieved.

If the theory of the manufacture now generally received be correct, I am not sanguine of great improvements being made in the process.

It is hardly possible to have purer or cheaper alkali.

The process of combination, by the joint action of steam and fire, or by steam only, is simple and rapid, and the treatment of the soap, cooling it in frames and then cutting it into bars, after the chemical process is perfect, cannot be much improved or cheapened; but if we seek for new principles under which the saponification may take place, there is room for great economy of the raw materials, and, therefore, for the production of an equally good, if not superior, article at a very much lower price.

At present, from 8 to 10 per cent. of the fatty matter used in soap-making is converted into glycerine, and is wasted. We make nearly 100,000 tons of soap annually, requiring 60,000 tons of tallow, oil, &c., one-tenth of which is absolutely thrown away. 6,000 tons, at £30 per ton, or £180,000 per annum, is the measure of this waste.

The quantity of fatty matter required to make a ton of perfect soap, is 13cwt., 3qrs., 0lbs., or 1540lbs., but analyse the soap so produced by what means you may, you cannot reproduce more than 1,400 lbs., not of tallow, but of fatty acid or hydrogenated tallow, and therefore representing really but little more than 1300 lbs. of tallow. The difference between these quantities is to be found in the glycerine. The question then arises, is tallow, according to the commonly-received opinion, a margarate of glycerine, or is glycerine a portion of tallow highly oxidised during an imperfect process of making the fatty acids?

Tallow is generally assumed to consist of—

Carbon.	Hydrogen.	Oxygen.
75·966	11·700	9·304

and glycerine of—

Carbon.	Hydrogen.	Oxygen.
40·017	8·925	51·000

but the fact that the glass in my hand contains sodium in pure tallow, appears inconsistent with this theory, and leads to the conclusion that tallow is a hydro-carbon. The composition of olifiant gas, the product of tallow, also appears to me to confirm this view.

When, then, this hydro-carbon is to be made into soap, it is combined with soda, and we have—

1. Fatty acids—carbon, hydrogen.
2. Soda—oxygen and sodium.
3. Water—hydrogen and oxygen.

And, in a separate form—

4. Glycerine—carbon, hydrogen, and oxygen.

The changes which have taken place to produce these results are, the decomposition of water, the hydrogen combining with one portion of the tallow, and the oxygen with another portion,—the one to form soap in combination with the soda, and the other to form glycerine.

It is immaterial to the theory of the manufacture of fatty acids and the production of glycerine, whether tallow contains oxygen or not. If there, it remains in the fatty acid. All I wish to show is, that glycerine is a portion of the tallow highly-oxidised during an imperfect, and at present ill-understood, process; and, to confirm this view, I believe it will be found that if an amalgam of sodium and mercury be triturated together with tallow, and water very carefully and gradually added, no hydrogen will be evolved nor glycerine produced.

Now every soap-maker knows that he cannot make soap with a soda ley above a certain specific gravity; and he also knows, by experience, that with a weak ley the operation is easier, and that the production of soap is greater in proportion as the combination is quick, and the number of operations or boilings whilst free grease remains, is few.

Again, if tallow be a margarate of glycerine, how is it that simple distillation breaks the combination, and produces margaric acid and glycerine, whilst the strongest soda ley will not do it, though a weak soda ley will do so?

But if we suppose that under the influence of a high temperature with steam the affinity of margaricine for hydrogen is increased, and a portion of water is decomposed, then we find all the elements of the two products, and we obtain margaric acid, or hydrogenated tallow, and glycerine, or oxidized tallow; and carrying out my views, I believe that, could the tallow, oil, &c., be distilled in hydrogen, instead of steam, no glycerine would be found.

By Mr. Wilson's process of distillation, he informs us that the proportion of glycerine is 8 per cent., but every soap-maker who has carefully watched his processes knows, that from causes but ill-understood, the product of soap from a given quantity of tallow varies very much, and I believe this variation is often put down to wrong causes, and really depends upon the rapidity of the combination of the alkali and the grease. If this be tedious, and the boiling in fresh ley oftentimes repeated, a serious deficiency arises in the quantity of soap produced, every fresh quantity of ley carrying off a certain portion of oxidized tallow or glycerine, as well as a portion of imperfect soap.

Now, knowing that this view of the process of soap making, and, indeed, of composite candle making, is not that generally accepted, I submit it with diffidence, and only ask that it may receive due and careful consideration from those interested in the subject; but, supposing my idea to be wrong, then another question of importance arises to the soap maker, viz.: why is not this vast quantity of glycerine, now entirely wasted, preserved and turned to useful account? and it is in this direction, either to prevent the formation of glycerine, and thus to increase the product of soap from a given quantity of tallow, or to save and apply to useful purposes what is now wasted, that I expect to see the first fruits of the relief of this important branch of industry from the trammels of the Excise.

DISCUSSION.

Mr. **Warren De la Rue**, F.R.S., said, he was sure that the meeting would agree with him that they were greatly indebted to Mr. William Hawes for his interesting communication read that evening, which must be considered of greater value as coming from one whose practical acquaintance with his subject ensured the accuracy of the facts he brought forward in illustration of his views. Before entering, however, upon a discussion of the *rationale* Mr. Hawes proposed, to account for the process of saponification, and of his views of the constitution of the neutral fats; it was well perhaps to pause and reflect how strongly his elaborate history of the soap manufacture in England brought out the indomitable energy and perseverance of the English manufacturer, both in remote and recent times. Having been charged, in 1851, together with Dr. Hofmann, to write a report on the products of Class XXIX., he could testify to the fact, as had already been done, that the British soaps manufactured under the then excise restrictions, did vie in excellence with the best productions of foreign countries. Again, it was gratifying to see recorded in the history of the soap manufacture, that the flood of public opinion in England, although for a term it might be pent up and restrained, would, in the end, sweep away the restrictive and injurious laws which press upon those manufactures most conducive to the health and well-being of the community. The duty on salt had scarcely disappeared, in 1823, before Leblanc's method of preparing soda from sea-salt, gave us, in the hands of a Muspratt, a cheap and excellent alkali, to be substituted in the manufacture of soap for an impure carbonate of soda, in the form of barilla, which we had to seek in Spain and Teneriffe. At the same time, and as a secondary product, we got chloride of lime to be used in our bleach works and paper manufactories, and we thus saw how intimately one branch of industry connected with another, and how the removal of a single obstacle gave room for development in a variety of arts. He had every hope, with Mr. Hawes, that in the course of time, now that the restrictions on the soap manufacture were entirely removed, that we should see improvements take place in the processes at present employed; at the same time, it must be admitted, that the old process was one of the most beautiful of chemical operations, although its discovery preceded by ages the scientific explanation of it, which the researches of Chevreul had brought out. While reflecting on all this, with the interest which attached to it, it was also pleasing to find, that within the domains of some of the administrators of our laws a spirit of enlightenment had broken down the bulwarks of circumlocution; for in his historical sketch, Mr. Hawes had placed it on record, that the present Board of Inland Revenue, headed by their gifted chairman, Mr. John Wood, had for years done all in their power to remove from the processes of manufacture they had to control, every restriction possible with the state of the law for the time being. The good thus done to the community was almost incalculable, and he believed at the same time the revenue was benefitted. Passing over the description of the processes of soap-making, so lucidly described by Mr. Hawes, he wished to make one or two remarks respecting the new theory of saponification that gentleman proposed, which, with all deference, he believed would not supersede that of Chevreul, who first established the analogy of neutral fats to salts, or rather compound ethers, a theory which every more recent investigation, for example, of Dr. Stenhouse, Pelouze, and others, had established on a firmer basis, and which had recently received a remarkable synthetical confirmation by the researches of Berthelot, who, by exposing fat acids in closed vessels, in contact with glycerine, to a high temperature, varying from 212° to 536°, had reproduced the neutral fats, and made also some interesting compounds not met with in natural productions. Mr. Hawes seemed to think, that because sodium might be kept in melted tallow without undergoing change, that, therefore, neutral fats could contain no oxygen, and that they were hydrocarbons. No deduction could be more fallacious. For years he had been engaged on the chemical examination of a series of hydrocarbons, and he had invariably found that the oxygen compounds they contained were removed with the utmost difficulty by the alkaline metals; that, for example, sodium might be kept for months in them without entirely decomposing the oxygen compounds, and that after this treatment these hydrocarbons might be boiled for days in them without entirely decomposing the oxygen compounds; and that, to obtain the hydrocarbons pure, it was necessary repeatedly to distil them in an atmosphere of dry hydrogen, from a retort containing clean sodium or potassium. Moreover, although sodium might be kept in melted tallow without change, yet, if the temperature was raised to, say, 400° Fahr., then a very violent action ensued, the sodium being oxidised at the expense of the oxide of glyceryl, an anhydrous soap being formed, and a hydrocarbon and hydrogen being evolved. Again, we should all be disposed to admit that water contained oxygen, as we knew that it could be formed by the combination of oxygen and hydrogen gases. We knew also that sodium decomposed water with violence, and, under certain circumstances, with deflagration; yet he had in his hand some water in which he had placed sodium, and there was no reaction. We should be wrong, however, in inferring that water contained no oxygen. He ought to have mentioned that he took the precaution of saturating the water with soda; and as the water could dissolve no more soda if produced, the sodium did not, when placed in contact with a saturated solution of soda, tend to decompose it. The fact that soap was not readily made with a soda ley might possibly be accounted for, first, by the fact that soap was not readily soluble in it, and thus the fat was protected from the action of the alkali; secondly, that the affinity of the concentrated ley for its water might prevent its readily yielding, to the oxide of glyceryl, the necessary water to combine and form its hydrate, glycerine. That the action of steam or water at high temperatures should split up the neutral fats into their acids and glycerine, while distillation, *per se*, or in an atmosphere of hydrogen, gave rise to other products, was explained also by the fact that, to form glycerine from the oxide of glyceryl, as it existed in neutral fats, the presence of water was needed. The facts mentioned by Mr. Hawes showed that he was a close observer of phenomena; and, although he (Mr. De la Rue) differed with him as to the explanation, still great value could not fail to be placed on his observations.

Mr. G. F. Wilson, F.R.S., said that as his friend Mr. Hawes, in the very valuable paper just read, had noticed an omission in a paper of his lately read before the Society—the not having sufficiently referred to the beneficial effect on the candle manufacture arising from the removal of the Excise duty,—he might be allowed to say that he brought this point forward in a former paper, and that he entirely agreed with Mr. Hawes in believing that had the excise on candles continued, candle-making would have remained what soap-making appeared to be—a somewhat improved, but still very imperfect, manufacture. He must beg as entirely to dissent from Mr. Hawes's opinion as to the effect of patents on manufactures; and as he had kindly instanced the Vauxhall works in support of another argument, he must allow him to instance them as showing the fostering effects of patents upon a young manufacture. Had they at Vauxhall not had the prospect of future protected years to pay for the expensive experiments necessary for perfecting their distilling machinery, they could not in prudence have ventured on the large necessary outlay. He was sorry to say that his knowledge of soap making was more theoretical than practical, having only had the opportunity of studying it on a small scale, but he had seen enough and heard enough of the necessities of the manufacture to be able to confirm what Mr. Hawes had shown of the great room for scientific improvements. He believed, however, that since the removal of the duty some improvements had been introduced, and that we were now not far behind the French manufacturers. Five years ago he visited one of the largest soap-works in the head-quarters of French soap-making, Marseilles; neither the chemical nor mechanical arrangements were especially good; indeed, the only striking objects were the workmen, who, working in the heat with their shoulders bare, were as fine specimens of men as he ever saw. With regard to the chemistry of soap-making, his friend Mr. De la Rue had so clearly stated the present most generally received theory, and with so much greater authority than anything coming from him on this chemical subject would have, that he need not occupy the meeting with any remarks on this head. To what Mr. Hawes had said on the future of soap-making, and the present waste of glycerine, he begged to add his confirmation. Late inventions seemed to make it probable that grease would find its way into the soap pan, only in the state of fat acids; or that if glycerine were ever present, it would be as an addition to the finished soap, on account of its softening action on the skin. Of the future of glycerine, he would only say, that it brightened daily—every day appearing to bring forward new uses for pure glycerine.

Mr. Dugald Campbell, F.C.S., wished to make a few remarks upon one or two points discussed in the paper. As a chemist, he differed materially from Mr. Hawes in the statement with respect to glycerine—namely, that a portion of the fatty matter, during the process of saponification, was converted into this substance, and that it did not exist originally in the fatty matter employed—and he might say that all scientific experiments hitherto were against that view. The experiment which Mr. Hawes had exhibited that evening to substantiate his theory, he (Mr. Campbell) considered was refuted entirely by those which Mr. De la Rue had said he had performed elsewhere, and which he did not doubt to be correct. Before leaving the subject of glycerine, he must say that he should be sorry if the meeting separated with the impression that glycerine was a waste product, for it was a most valuable one, and far more so than soap, or any of the materials from which soap was made. He wished Mr. Wilson, as he was a large producer of this article, while speaking upon the subject, had detailed to the meeting the numerous applications it had, and its money value, which could not be under 4s. per pound. Mr. Hawes had stated, truly, he did not doubt, that he was in the minority in this Society in the view he had taken upon granting patents for inventions, which was that they were injurious both to the patentees and to the public. Now, he (Mr. Campbell) ventured to say that in every society over the civilised world he would find himself in a similar position. Upon what grounds Mr. Hawes had ventured to make this assertion it was difficult to conceive. How had many of our poor men risen to be great men? he need not name them—they were numerous—but by inventions, which had been secured to them by patent-right, otherwise they would have been plundered of them by some of their more opulent neighbours, who had the means to make use of them, whilst they had not. Even under our laws, this was done to a certain extent now. That invention was to a state a great prosperity could not, he thought, be doubted, and to foster it seemed the great aim of every progressing nation; and in no other way did it appear likely to him to be advanced but by patents, easily, cheaply, and effectually secured. As a proof of what he asserted, he might allude to what had been doing in this matter lately in other countries. In Belgium, for instance, by a late enactment, patentees only paid 10fr. for the first year of their invention, 20fr. for the second, and so on increasing every year by 10fr. The Minister of Agriculture, Commerce, and Public Works, in France, no doubt at the suggestion of the Emperor, who saw the benefit the country had received from the acts in the same direction by his late uncle, had addressed a circular to the different Chambers of Commerce in France relating to the modification of their now existing patent laws. This had been replied to by the *Société des Inventeurs et Artistes Industriels* agreeing, in a great measure, with the views which were to secure and cheapen inventions, the payments to be made upon the principle legalised in Belgium. The Commissioner of Patents in America, in his annual report to the Speaker of the House of Representatives, had recommended a great modification of their system of granting patents. He alluded to the large fees which were paid for patents in this country, and referred to the great benefit which a country derived from inventions, advising that every liberty and security should be given to those men, upon whom the elevation of a country greatly depended. The documents to which he had referred were published in the *Commissioners of Patents' Journal* of this country of the 11th, 14th, and 18th of March of this year. When speaking of the circular of the French Minister, he omitted to state that so much benefit did he consider inventors to be to society, that he would go so far as to grant to those who could not find the funds for the first annual payment, six months to enable them to procure it.

Mr. Robert Low said he could add but little to what had been already stated on the subject before the meeting. He belonged to the class called manufacturing perfumers, who adopted the processes so clearly and forcibly pointed out by Mr. Hawes; they merely re-worked the manufactured article, and they produced the quality called fancy soap. He thought Mr. Hawes had been too modest in his mention of what had been done by his predecessor, his respected father, in the finer descriptions of soap. He was one of the first manufacturers of the curd soap, which perfumers had used very extensively since that time; and had it not been for the great ingenuity displayed in the manufacture of soap, they would not have had the quality of article they now had.

Mr. Winchester said he would mention one use to which glycerine had been applied, as important, he believed, if not more so, than any hitherto brought to the notice of the Society, viz., the preservation of vaccine lymph. A small portion of glycerine mixed with recent matter would preserve it in a moist and perfectly pure state. Mr. Cheyne, who introduced this method, had, for the sake of experiment, kept lymph, so prepared, for some months, and on using it, found it as efficacious as if it had been just taken from the arm. The difficulty of obtaining a supply when most needed, together with the too frequent failure attending the use of dry lymph, tended greatly to favour the spread of small-pox, and to curtail the usefulness of vaccination. The full benefit of the Compulsory Vaccination Act could not be obtained unless the supply of vaccine lymph was equal to and ready at the instant of demand. By preserving it in this way the supply might be rendered inexhaustible. Anything, therefore, which tended to facilitate vaccination, and thereby either altogether prevent or modify small-pox, must be considered a public boon. Such was glycerine in this application of it.

The Earl of Caithness said, from what they had heard that evening, it appeared that the price of soap had been reduced so as to be within the reach of the poorest classes —a great blessing in a sanitary point of view. If by the aid of science they could find a means of still further reducing the price of that important commodity, so much the better, both for the manufacturer and the user of the soap; and he trusted that science was not so far behind in the present day as not to be able to find some more perfect way of producing an article at a cheaper rate than the soap they at present used. With regard to the excise duties, he believed the opinion was very general that they were irksome and disagreeable. The excise, however, in many instances must be exercised for the benefit of the country, and for the maintenance of its revenue. For instance, there was an article which was very largely imported from his country—whiskey; every one, no doubt, disliked the excise duties upon that, but he was afraid the revenue would be a great loser if the excise were taken off it. At the same time, he must say that the taking the excise duty off soap had produced most beneficial results, as had been shown in the paper read that evening, and the more the Excise could be taken off all articles that conduced to sanitary purposes the better. There was another article he should like to see the duty taken off entirely, that was paper. He thought the duty upon paper was a damp upon the instruction of the poorer classes, and indeed of all classes of the community, and operated against its improved manufacture; and if he had any word in the matter, he should certainly vote in favour of taking the duty off paper, and he hoped before long that it would be effected. They had to thank his brother-in-law, Lord Duncan, for the repeal of the window duty, which was a great sanitary comfort to all classes, because they might now have a house with as many windows as they liked, without a dread of the duty. Still they must look to the maintenance of certain excise duties, otherwise the revenue would not be kept going. He would beg to ask one question of Mr. Hawes, which was as to the difference in value in the manufacture of soap between barilla and kelp. He asked the question because he was personally interested in the manufacture of kelp. To those who were located on the coast of Scotland knew what was formerly the value of kelp. Some years ago, his grandfather realised as much as £21 per ton for kelp, and, as might be supposed, it brought him in a very considerable revenue; and he knew a gentleman on the west coast of Scotland who, he believed, realised as much as £10,000 a year from kelp alone. That gentleman, owing to kelp being dispensed with, was, he might say, almost ruined; and it had made a considerable difference to many proprietors on the coast of Scotland—in fact, on all coasts producing kelp. He did not say this from any wish to deteriorate the value of barilla, or to prevent the use of an article that was best suited to the manufacture to which it was applied, and he should be sorry if the manufacturers did not use the best article, but he should like to hear, from so good an authority as Mr. Hawes, the difference in value of the two commodities in the manufacture of soap. With regard to the Patent Laws, he thought, with Mr. Campbell, that they were in many respects of great advantage, although, perhaps, there were strong arguments in favour of their entire abolition. Still he thought it a hard case that a man who was an inventor should not have some slight protection by paying for it, which went to assist the revenue of the country. He thought every one ought to have some short time allowed to gain something by his brains. A man could not be expected to work for nothing, but he looked to be paid for what he did; and, therefore, it seemed to him a hard case that a person who was an inventor should not be allowed some trifling protection, limited, if they chose, to a short period, but sufficient to enable him to perfect and bring out an invention of his own, till it came to be in a workable condition, when he might either give it to the public or make something of it if he could.

Mr. Wibrow thought Mr. Hawes could not have forgotten one circumstance, showing the operation of the patent laws upon the soap trade. The price of Doe's patent iron frame was originally eleven guineas, but as soon as the patent expired they could be obtained for four guineas—the enormous difference in price being attributable to the patent.

The Chairman then rose to propose a vote of thanks to Mr. Hawes for his interesting paper. In so doing he could not help referring to one portion of the paper, and also to the observations that had followed upon it, which were not strictly connected with the subject under consideration—he alluded to the remarks upon the patent laws, which had led to several digressions from the subject of the evening. As, however, such digression had been permitted, he could not sit down without joining in the expression of opinion with those few who happened to coincide with him, for, like his friend Mr. Hawes, he was one of a small minority on this question. He did not agree at all as to the advantages of patents. He quite agreed with the noble lord who had spoken, as to the desirability of protecting, as far as possible, a man's property, whether it was in the power of invention, or any other good thing that was within him, and still more would he protect, in every possible way, the property in inventions of those who possessed but little other property— the powers of the inventor and the ingenuity of the workman, but having had some considerable experience with patentees, manufacturers, and workmen, he was of opinion that any practical benefits derived from the patent laws did not compensate for the injury inflicted. He believed, on the contrary, that both the inventors and the public greatly suffered from the attempt to protect inventions. He had had great experience on this subject, being compelled daily to examine inventions of various kinds, and having himself constantly to invent in the occupations in which he was engaged Having, then, all his life been connected with inventors and workmen, he had witnessed the injury, the waste of mind, the waste of time, the excitement of false hopes, the vast waste of money, caused by the patent laws, in fact, all the evils which generally resulted from the attempt to protect that which did not naturally admit of protection. He agreed as to the abstract desirability of protecting inventors in some way, provided it did not foster unhealthy invention, as he thought it desirable to protect every species of property that existed. He was disposed to encourage every step towards facilitating the obtaining patents; he hoped they would be made dirt cheap, as he thought that that would be the most effectual way of destroying them altogether. Therefore, whenever he had been consulted on the subject of the Patent Laws, he had always advocated the rendering of patents as open and free and cheap as possible; in the first place, because he saw no reason for attaching a price to them, and, next, because they would sooner arrive where the principle would be fully tested. We were already nearly arrived at that state of things when engineers were almost brought to a dead stand in their attempt to introduce improvements, from the excess of protection. He found that he could hardly introduce the slightest improvement in his own machinery without being stopped by a patent. He could mention a striking instance, in which, a few months ago, wishing to introduce an improvement that he thought would have been valuable to the public in a large work on which he was engaged, he had no sooner entered upon it, with a willingness to incur considerable expense in the preliminary requirement, and in the trial of it, than he was stopped by a patentee; but he was fortunate enough to find that another patentee existed of the same thing, and a week after a third appeared. There was thus, fortunately, a probability that, by the destruction of all value in any of the patents, he might be able to continue the improvements he was desirous of introducing. He concluded by moving a vote of thanks to the author of the paper.

Mr. **Hawes** returned thanks. He would briefly advert to one or two of the observations which the reading of the paper had elicited from gentlemen who had taken part in the discussion. In the first place, he would endeavour to give the noble lord the information he desired with regard to the relative value of barilla and kelp in the manufacture of soap. He might say that barilla was no longer an article of commerce; the cheapness of alkali made from common salt had destroyed that trade. But kelp might be regarded not so much as an article used in the manufacture of soap, as producing other substances cheaper than they could be obtained elsewhere; for instance, from the weed-producing kelp, a large quantity of that useful article, iodine, was produced. But the value of kelp must always remain comparatively low, because the value of salt was low, and he thought it useless for the landlords of Scotland to expect that a large income would be again derived from that source. This was one of the penalties paid by the few for the benefit of the many, which they must be content to submit to, and he thought the noble lord would be the last to wish restrictive laws to be placed upon alkali.

The Earl of **Caithness** would mention the difference of price in the article of kelp,—whereas formerly the price was £11 per ton, it was now only about 11s. per ton.

Mr. **Hawes** added—With regard to the observations that had been made with respect to patents, he would say nothing after the remarks of his friend the chairman. He thought this subject was generally viewed from the inventors' side only. To compare great things with small, he might characterise the former Corn Laws of this country as the agricultural patent for the benefit of the few to the injury of the many, and in like manner every patent was a price paid by the public to the inventor. With regard to the glycerine question, he could not admit that he was wrong in his theory because certain authorities were against him. He thought there was room for research and enquiry whether the formation of glycerine could not be altogether prevented, or whether it could, upon production, be turned to more profitable account than was at present the case. Such experiments, however, could not have been carried on whilst the excise upon soap was in operation.

The Secretary stated that the Paper to be read on the evening of Wednesday next, the 2nd of April, was "Description of Improved Apparatus for Teaching Mechanics in Schools," by Prof. Willis, F.R.S. On this evening Sir John Rennie, F.R.S., will preside.

EXAMINATION OF CLASSES IN INSTITUTES.

HANTS AND WILTS ADULT EDUCATION SOCIETY.

At a meeting of the Committee, held at Basingstoke, on the 19th March, 1856,

It was resolved,—That subject to the following conditions, a sum not exceeding £1 be allowed for travelling expenses to members of Institutions in Union with this Society, who may be desirous of presenting themselves for examination at the Society of Arts in June next.

Conditions.

I. That, during six months at the least, the candidate shall have attended a class or classes of instruction in his Institution, if any such classes have been held.

II. That, on or before the 15th of May, he shall send a written notice of his intention to present himself for examination, and in what subjects, addressed to the Hon. and Rev. S. Best, The Rectory, Abbott's Ann, Andover.

III. That, together with the aforesaid notice, he shall forward a certificate, signed by the President and Secretary of his Institution, attesting, 1st, his respectability and general good conduct; 2ndly, his fitness for examination in the subjects he selects; and 3rdly, stating their belief that the assistance offered by the Society is of importance to the candidate.

Colonial Correspondence.

THE NATURAL RESOURCES OF BRITISH HONDURAS.

Belize, British Honduras.
Feb. 15, 1856.

Sir,—In the last letter which I had the honour of addressing to you, I brought under your notice a favourite fish in this part of the world, and caught in the waters of this hemisphere, called the callipever. If I recollect rightly, I pronounced a rather glowing eulogium upon its merits,—an eulogium which might appear to be prompted by the imagination, rather than suggested by the reality. I do not, however, feel disposed to retract a single syllable from what I then said, but, on the contrary, I am prepared (I think) with evidence in support of its correctness. But of this you must judge. I have sent you six of these fish, caught and cured by the Spaniards. Although it is impossible, in their salted state, to form anything like an accurate opinion of their flavour when newly caught, they are still far superior, when cured, to the cod and ling of England and Newfoundland; the latter being dry and coarse, and the former fat and delicate. I am not sure, if the callipever, when fresh, were preserved in oil, that it would not be equal to the tunny fish of the Mediterranean, which is so highly prized by gourmands, especially on the Continent. There is not the slightest doubt that the callipever may be caught at certain seasons of the year in immense quantities at the mouths of all the principal rivers in British Honduras. The largeness of the roe alone indicates that it must be a plentiful fish. I am sure that a valuable callipever fishing might be established here. "There is as much fish in the sea as ever came out of it," is an old saying, and it is a true one when applied to oviparous fishes, which no extent of deduction can exhaust. It may not be so in reference to certain cetaceous fish, which might probably be driven by constant depredations from one sea, to seek repose and quiet in waters less frequented, as it is said the whale, from the continual invasion of its ice-girt home, has forsaken the Greenland seas, and swam for refuge to some unknown deep.

I also spoke of the roe of the callipever, and described it as being in my opinion equal to caviare. Caviare is made of the roe of the sturgeon, the sevruga, the beluga, and the sterlet, fishes which are caught in the rivers and lakes of Russia. There is a great sturgeon fishery at Pillau, in Prussia, large quantities of that fish being caught in the Haff-curische, and the Haff-frische. The finest caviare is said by some to be made of the roe of the sterlet, which is very plentiful in the rivers which flow into the Caspian. Others give the preference to that which is made of the roe of the berluga, which is caught in the Wolga. A caviare is made in Norway, from the ova of the porpoise, but is only suitable for a Norwegian stomach. The great mart for the best caviare is undoubtedly Russia, and that delicacy, according to M'Culloch, is one of the principle articles of her trade. Now, I really think it is desirable, whilst we are at war with that country,—a war which, notwithstanding rumours of negotiation, and whisperings of peace, presents as yet all the diagnostics of durability,—that we should cast about in our own colonies, and endeavour to discover amongst their various productions, marine and terrene, articles similar to those which have constituted her trade with Great Britain. In the course of my correspondence with you, which you have kindly thought not unworthy of a place in your *Journal*, I have stated three articles forming a part of the Russian imports into Great Britian, which this country is capable of producing to a very considerable extent, namely, pitch, oil, and hemp. No reader of modern history is unacquainted with Napoleon's "Continental System," by which he hoped to impoverish the British nation by ruining her export trade; a vain expectation, which proved that he was completely ignorant of the internal wealth and resources of that country. The wealth of Russia, her means of existence as a great power—it is universally admitted, depend upon her exports; and, if it be our duty at the present time to close and barricade all her doors, and shut up within herself all her natural and manufactured productions, it is equally our duty to endeavour to supply from our own resources that deficiency in articles of necessity or luxury as such a course of conduct is calculated to occasion. If we succeed in this attempt we shall not only be able to supply our temporary wants, but we shall be, in a great measure, independent of the markets of Russia when peace shall have been happily restored, and thus our own dependencies will be permanently irrigated by means of the new channels which the current of trade will have dug. I have little doubt that many of our colonies contain vast stores of mineral and vegetable wealth, which only require energy and enterprise to develop. But it unfortunately happens that when once a particular trade, or manufacture, has been established in a country,—originally, perhaps by accident, it is thought that that country is unfitted for any other branch of commerce, and the people go on treading in the footsteps of their fathers, and moving in the same line, with as much exactness as a carriage on a railway. Mahogany has always been the staple commodity of Honduras, therefore, it can produce nothing else. Sugar and rum have been the products of Jamaica, therefore it can produce nothing else; this error exists to a great extent in every part of the world. But it is an error, for there is scarcely a country under the sun which, by skill and industry, may not be made to yield a great variety of valuable materials to contribute to the natural wants and artificial appetites of man. Now is the time, then, when every person possessing wealth and influence in our colonies, should apply a portion of that wealth, and exercise that influence, in bringing forth from the earth the many stores which nature has concealed within her womb, and which only await the obstetric hand of cultivation to spring up in rich variety. It has always appeared to me that those who are intrusted by the crown to administer the affairs of our colonies, are more intent upon loading the tables of the Houses of Assembly with projects of law, and of proposing impracticable theories, than in directing the attention of the colonists to those pursuits and occupations which would be far more profitable to them than frothy harangues and newspaper phillippics; than in awakening a spirit of inquiry, arousing a feeling of competition, and kindling an energy of mind in respect to those substantial matters in which their real interests lie—on which their prosperity, independence, and happiness depend. In every colony, if one article of trade be exhausted, there will always be another to supply its place. If a channel of commerce be dried up in one quarter, a new fountain will bubble up in another. What does it signify that the mahogany trade of Honduras is at its last gasp? There are thousands of other materials that will fill, and more than fill, the vacuum which would be caused by its demise. What does it signify that Jamaica has been beaten by Cuba and the Brazils in sugar and rum? The soil of that beautiful island can produce hundreds of valuable materials beside the cane, and beneath its surface there are rich veins of copper.

I have said that I have already brought under your notice three productions of this country similar to some of the articles which form a part of the Russian trade; I now mention a fourth—the roe of the callipever. The mode of curing this delicacy differs widely from that in which the roe of the sturgeon and the sterlet is prepared. The following is the account given by Goldsmith, in his "History of the Earth and Animated Nature," of the way in which the latter is manufactured:—"They take the spawn, and, freeing it from the small membranes that connect it together, they wash it with vinegar, and afterwards spread it to dry upon a table; they then put it into a vessel with salt, breaking the spawn with their hands, and not with a pestle. This done, they put it into a canvas bag, letting the liquor drain from it. Lastly, they put it into a tub with holes in the bottom, so that, if there be any moisture still remaining, it may run out; then it is pressed down, and covered up for use."

Very different is the manner adopted by the Spaniards in this country in curing the roe of the callipever. They do in this wise:—First, they rub the roe well with salt and a little nitre, then they put a number of them one upon another, and compress them by means of a heavy weight. After this, they make a kind of altar of green boughs, covering the top also with green branches traversing each other. The inside being filled with straw and fresh leaves, which are ignited, they place the roes on the top, and cover them well up likewise with green boughs. They are allowed to remain there six or seven days, during which time the fire keeps smouldering and sending up a thick smoke, which is concentrated upon the roes by the upper layer of branches. This they call barbecuing. The membranous covering of the roe is not taken off, consequently it will keep for a long time, the air being entirely excluded from it. When the roe is eaten, it should be cut in very thin slices. The outer coating should not be taken off, but rubbed clean with a dry napkin. I have sent a dozen of these roes, in order that you may form an opinion of them.

Having spoken of the fish, and of the roe which it contains, I must now make some observations respecting the scales of the callipever. These are rather larger than a sixpence, and in the form of a horse-shoe. They are of a pearly whiteness, and when held to the light they exhibit a series of veins resembling the water-marks in paper. I have thought it not impossible that these scales might be made available for inlaying in cabinet ware and *papier maché*. They may be entirely worthless; but, at all events, I see no harm in bringing them to the notice of your Society. I send you by this packet a small box of them.

A pretty good trade in peltry might be carried on in this country. The immense forests of British Hondura are plentifully stocked with animals, *feræ naturæ*, of many descriptions. The cougar, the jaguar, the ocelot, the ant bear, and the silver fox, are a few of the principal. The cougar is by some called the American lion; by the inhabitants of this country it is known as the red tiger. A full-grown cougar is not much inferior in size to a Bengal tiger. The colour of the skin is similar to that of the lion, but a little redder, and it becomes white towards the belly. A darker streak runs down the back and the middle of the tail. It is a very fierce animal, and never hesitates to attack man. The flesh of it is eaten, and is said to be agreeable food. The injunction of St. Paul, "to eat what is set before us, and ask no questions for conscience sake," would hardly be a safe maxim to act upon in this country, at an entertainment given "under the greenwood tree," by the "Ancient Foresters" of Honduras. The sylvan dainties would not be composed of precisely the same materials as a *petit diner* at the *Trois Frères* or the *Café de Paris*. The jaguar, which is also called a tiger, is in size between the Asiatic tiger and the leopard. It is spotted, but not in the same manner as the last-mentioned animal. The spots are not round, but in different shapes, some being longitudinal, some shaped like a horse-shoe, and some triangular. These marks are a glossy jet black, and they look very lustrous, sprinkled as they are over a ground of a bright reddish yellow. The jaguar exists in great numbers in Honduras, and it is not unfrequently killed close to the town of Belize. Hogs are a great temptation to him; and wherever there is a swinish settlement, a jaguar is sure not to be far off, *with a sty in his eye*. Although a formidable brute, he is not courageous, and will never attack man if he be not molested—nay, he will even fly from his approach. What amiable qualities, what desire for human acquaintanceship, hunger might develop, I am not able to say. But hunger is unknown in this country; for quadruped and biped there is enough, and more than enough. To the soaring pelican, who with "fell swoop" dives headlong into the wave with unerring aim for his scaly prey, to the cougar and the jaguar, who pounce, in their well-stocked woods, upon the heccary, the antelope, and the deer; to the turkey buzzard, vulgarly called the "John Crow," who plunges his foul beak into the rotting carcase; to man, who, without leave or license, seizes an acre or two of crown land, and plants therein his yams and plantains, to be exchanged in the fulness of time for "gin and baccy," hunger is unknown. Scarcity is doubtless an evil; but is the entire absence of want an unmixed good? No country can become great, virtuous, and rich, which produces the necessaries of life with little or no labour,—where the Juba tree of the Mohammedan Paradise may be said to grow, from the branches of which hang in tempting clusters the most delicious fruits—ducks roasted to a turn, and turkeys stuffed with truffles—coats and waistcoats, hats and umbrellas. Labour is a condition of prosperity and happiness. Where there is no want, there will be no labouring class; and where there is no labouring class, there will be no progress. Where there is no necessity for industry, there will, of course, be indolence, and indolence is the nurse of every vice,

> "For Satan always finds some work
> For idle hands to do."

This is very much the condition of Honduras, and, I believe, of many of our West India colonies. It does not fall within my province at present to trace the causes of this deplorable state of colonial affairs; but I should have little difficulty in performing the task, if I were to set about it. To return to the jaguar. I said it was not naturally a courageous animal, although of great size, possessing vast muscular strength, and furnished with a full complement of tusks, teeth, and sheathed claws. Some years ago, I went with my family to reside for a month or two at a cattle-pen on the Settee river, which is about forty miles to the southward of Belize. The house in which we "located ourselves," as our dear brother Jonathan would say, was a large wooden structure, seventy feet long and forty wide. In this capacious dwelling there were only three rooms—a sitting apartment, which ran along the whole front of the building, and two bedrooms behind, with a passage between them. The situation was most romantic. A large space of ground, consisting of about twenty acres, was cleared round the house, which was shaded by the stately mountain cabbage, the plume-like cahoun, the umbrageous fig, and the tall, widely-spreading, wild cotton tree. On the west were the mountains, covered with dense forests, where the human foot had not trodden for centuries, the contemplation of which could not fail to awaken strange mysterious feelings, and give rise to various speculations and conjectures. What was on the summit of those distant hills, and what kind of country was beyond them? What unknown trees and plants did those forests contain? Were there any structural remains of man's handiwork? Were there any vestiges of a race long since departed from the earth? The native Indians, and the Negroes as well, have an odd idea about those forests. They believe that they are inhabited by a race of people with strange features, and faces looking backwards—a sort of

> "Anthropophagi, and men whose heads
> Do grow beneath their shoulders."

At our feet flowed the river, as it had flowed hundreds of years ago, and as it might flow perhaps hundreds of years hence, when some philosopher probably would stand upon its banks and speculate on our fossil remains, here and there dotted with little islets, some of which, like those of Pactolus, were covered with golden sands, and some with a very fine white gravel. In this retired spot, when the shades of evening began to deepen around us, numberless were the sounds which fell upon our ears from bird, beast, and insect. One evening whilst we were availing ourselves of the short interval between sunset and thick darkness, by taking a cool walk, we were suddenly startled by a noise like distant thunder, which appeared to come from the earth under our feet. We rightly conjectured that it proceeded from a tiger, which animal we imagined must be in a jungle about ten yards off. Fear, which exaggerated our danger, very fortunately did not paralyse our legs, but, on the contrary, imparted to them extraordinary agility. After we were safely housed, we were informed by the cattle-man that it was really a tiger which we had heard—that it was at least a mile off—that it was tempted by the calves which were confined in an inclosure under the house, and that no doubt at night it would endeavour to appropriate one of them for its supper. This man had a little Scotch terrier, one of those saucy-looking curs such as Landseer has so admirably represented in his picture of "Impudence and Dignity." We did not fail to make all the doors and the windows perfectly secure, for the idea of a tiger breaking into the room at the dead of night, and carrying one of us away *à la Munro*, was not productive of agreeable sensations. So as we wanted "none of his jaw," as I said before we made all fast. About midnight the prophetic words of the cattle-man who verified. Our growling friend paid a visit to the calves. Being all locked up, however, there was no fear that the awful tragedy of Red-riding Hood and the Wolf, *mutatis mutandis*, would be repeated for the benefit of the jaguar. It made several furious attempts, by rushing against the door with all its might, to procure its anticipated veal, but the fatted calf was not destined for such a prodigal. An unexpected actor appeared upon the scene. This was no less a personage than the Scotch terrier. He went most audaciously up to the jaguar, and by dint of barking, snarling, and snapping, at length drove him fairly from the field. I do not like to make invidious comparisons, but I think the exploits of the celebrated dog Billy, which adorn the historic page, must sink into insignificance when compared to this achievement of the Honduras cattle-man's terrier. One single blow of the tiger's paw would have crushed the little animal. But that blow was not made, and the cowardly giant sneaked away from the gallant dwarf. Similar occurrences take place every day, when, instead of the *flesh* the *skin* is only deserved.

> "Thou wear a lion's hide! doff it for shame,
> And hang a *calf's skin* on those recreant limbs."

In the morning I had an opportunity of judging of the size of our veal-hunting visitor. He left the impress of his paw upon the soft clay, and from its dimensions there could be no doubt he was one of the largest of the species.

The ocelot, or cat-a-mountain, or tiger-cat, for it is known by these different appellations, is a much smaller animal than the jaguar, but it is a great deal fiercer. It is, indeed, a very dangerous beast to fall in with. Whether molested or not it will attack a man, and even follow him up a tree, if he should resort to one for safety. The spots upon its skin are similar to those of the jaguar, but the colour of the ground varies. Sometimes it is a reddish yellow, and sometimes a dull grey. I have sent you the skin of one of these animals, as well as one of a small cougar.

The calabash tree of this country, of which there are several kinds, supplies to the natives, in a very great measure, the place of the potter. The fruit of this tree is surrounded by a thick, woody shell, which is applied to a variety of purposes, such as basins, drinking cups, bottles, &c. They are sometimes carved and ornamented by the Indians with that sort of artistic skill peculiar to savages, whose ideas of the beautiful might be open to some objections, and whose tools are extemporised out of bits of bone, sharp flints, and other accidental materials. I have sent you a number of these calabashes so ornamented, which may be considered curious if nothing else.

The Indians of Guatimala manufacture a rude pottery out of the red clay of the country. The vessels which they fashion are of various forms and sizes, but the purpose to which they are applied is, for the most part, that of cooling water, to which they are admirably adapted, from the porous nature of the substance of which they are composed. Some of these vessels are not without a certain degree of classic elegance, at least in the design, which, to say the truth, is but clumsily carried out in the execution, and all of them have the stamp of the days of old. I suspect that the fashion, uses, mode of manufacture, and the material of which these vessels are made, are strictly traditional. I have little doubt that they have been transmitted, unaltered and unimproved, from a very early period. The Indians of the present day are a degenerate and uncultivated race, and are quite incapable of any new invention. They can only do what their fathers did before them, and that in a ruder and much more inartistic style. These utensils then, may, I think, without any very great sketch of imagination, be considered to be not very dissimilar from those which were made by the ancient Egyptians or Phœnicians, and the mode of manufacturing them is probably the same now as it was centuries ago. I have sent you a few of them, although, perhaps, they are not strange to you.

There are many remains, in different parts of British Honduras, of towns, temples, and of a people which existed ages ago. There can hardly be a doubt that the continent of America was very numerously inhabited by a highly civilized people, many hundreds of years anterior to its discovery by Columbus and his successors, at which period there is reason to believe that the natives had greatly retrograded from the moral and intellectual status of their ancestors, and only exhibited the relics of a decayed mind, the shreds and patches of a worn-out intelligence, How that vast continent came originally to be peopled, is a question which has often been asked, and often attempted to be answered, but it is a fruitless inquiry.

There are many ways in which the inhabitants of the Old World could have been conveyed thither. It is not at all necessary to resort to the doctrine of the ethnologists, that the Indians of America are a separate race, and have a different descent. The correctness or incorrectness of the Mosaic account of the creation need not be discussed in reference to this question. But, in whatever way the country became known and peopled, known and peopled it unquestionably was, at a very early period. The town of Belize is called from the river on which it is situated, which, it has been said, derives its name from a famous Scotch pirate, rejoicing in the patronymic of Wallis, who rendered himself, in the good old buccaneering days, notorious for his daring exploits in these seas. The W, somehow or other, got changed to a V, and then the Spaniards always pronounced the letter V like a B; hence Baliss, Balize, or Belize. This etymology has been adopted by Mr. Montgomery Martin, and almost every other person who has put pen to paper for the purpose of describing this country, without any inquiry as to its correctness,—and without any satisfactory evidence that the *etymon* himself ever had an existence. What will these gentlemen say, when I tell them that this derivation is an entire fiction? The late Mr. Wright, who was for many years a mahogany cutter in Honduras, and grew rich by that trade, at a time when a person might in this country "cut his stick" to some purpose,—was a man of considerable ability, and coming from an island which has been called, in the language of song, both a "gem" and a "flower," he was sometimes a little more ingenious than authentic. He it was, I have reason to believe, who first introduced Mr. Wallis to the notice of the public as the proud individual to whom Belize was indebted for a name, the said individual never having any "local habitation" whatsoever, it is supposed, except in the Milesian imagination of Mr. Wright. Besides, it is an undoubted fact, that rivers and mountains never lose their ancient names, which are given to them because of some peculiar feature or characteristic existing in themselves, or on account of some extraordinary event having taken place in their immediate neighbourhood. For instance, you may have Deep River, Great River, Black River, or a river called after some battle which had been fought, or after some deity, but it is not at all likely that the aborigines of a country would have discarded the ancient name of a river, to call it after a modern name. Now the Indians always say the "Belize river." Mr. Kennedy, who was for many years a judge of the mixed commission in Havana,—a gentleman of remarkable intelligence, and a good antiquarian, conjectures, with much appearance of reason, that the name Belize is derived from the two words Baal, Bal, or Bel, all signifying the same deity, and Itza, a city, or place; and that Belitza was given to the river in consequence of a statue of Bel having been there erected, or a temple dedicated to that deity. In Guatimala there is a town called Ysabal, from the river beside which it is built. This is the same word transposed. Ysabal is Itzabal, or Bal-Itza. Bel, signifying the sun, was a Phœnician deity, as Osiris was Egyptian. These names, then, and many of the remains which are found in this country, render it extremely probable that a great part of Honduras and Yucatan was colonised by the first-mentioned people—a party of whom, sailing as they did in those days, before the invention of the compass, by the sun and the stars, might have drifted, during a tempest, whilst those luminaries were obscured, into another hemisphere, and beheld, with astonishment and awe, when, after many days, the winds sunk and the skies cleared, new constellations, a more effulgent moon, and a more glorious galaxy than those which shone upon their Eastern home. Relics of different kinds are constantly being found, such as portions of edifices, arms, legs, and heads of images, vases and spear-heads. At a place called Corosal, in the northern part of this settlement, these remains more particularly abound. None of those which I have seen appear to have been sculptured, but moulded out of the clay, and baked. I send you the head of an image which was discovered at Corosal. It has been formed by the hand, and baked in the fire, the marks of which, notwithstanding its antiquity, may be observed under the chin. The features resemble those of the Indians of the present day. The head is represented as being within the jaws of a wild beast, most likely a jaguar, from the roundness of the forehead and the shape of the ears. From the closed eyes and protruding lips of the human face, the man is evidently intended to be dead, and the placid and rather smiling expression of the countenance is that which has been often observed upon the features of those whose death has been occasioned by pressure upon the spine.

I have sent you two bags of the ground-nuts, or pindars of this country.

I have, &c.
R. TEMPLE.

Home Correspondence.

PATENT REFORM.

Sir,—My opinion has been asked as to what would be the effect of throwing open to the public provisional specifications at the end of four months?

The first and obvious result would be, limiting to four months instead of six, the period for specifying. If the patentee were poor, he could not safely avail himself of the latest period for sealing, for, unless he sealed before publication, he would be exposed to the machinations of unscrupulous wealthy rivals.

The object of the provisional specification is to fix the identity of a new invention at the time of getting protection, and prevent interference with others who may come after him. But the provisional is not a final specification, and, if thrown open, all kinds of squabbles would ensue in the interpretation by others.

It may happen that after a man has taken a provisional specification he finds he has omitted something. In such case he will apply for a new provisional specification and abandon the old one. To a poor man sufficient time is very important. The rich man would prefer a law for putting in a specification complete, just as he would prefer high fees, because he can afford to waste money, and that puts his poor rival at a disadvantage.

The provisional specification fixes an idea. It does not prevent a patentee, with an original idea, from also provisionalising. It is true that he may provisionalise the same thing that some one has locked up in a previous provisional, but that must be the fault of the officers who examine, and in such case he should have his expenses returned to him, as being a false grant of what he had no means of ascertaining for himself.

The length of time may be too long or too short, but assuredly the secret should be kept till the man gets his right completed.

I think, however, that a discretion might be exercised as to prolonging the time allowed for specifying to an inventor desirous of keeping clear of some one immediately before him, and also of allowing a few months' extended time to the patent, to compensate for his unavoidable loss of time.

It is obvious that, notwithstanding the provisional specification is intended to secure a right, few people trust to it, but keep their secret till they have specified.

With regard to the cost of patents, it is a mistake to suppose they are cheaper under the New Act. It is true that a man gets a patent for the three kingdoms for £170, but he could, before the alteration, get a patent for England and the colonies for £120; and, in very many cases, Scotland and Ireland are of little importance. Nay, sometimes it was an advantage to leave Scotland and Ireland open to the public, as it stimulated the introduction into England. But, beyond this, for his £120 he got a patent for a series of improvements; for example, a very common title was, "Improvements in railways and engines and carriages to run thereon, applicable to other like purposes." Under this title, for England, came rails of any number of kinds, switches and crossings, turntables, station roofs, signals, lamps, couplings, wheels, axle-boxes, springs, buffers, carriages, boilers, pistons and cylinders, fire-boxes, engines generally. Under the present system, this would involve some eight patents, amounting to £1,360; while, formerly, the utmost cost for the three kingdoms was about £380. It is true that patent agents allege that such patents were "omnibus patents," and unsafe, but their interest speaks in the matter. With Lord Brougham's Act of Disclaimer, the patent, if *bona fide*, and carefully drawn, was safe enough under any fair system of laws.

Nevertheless, to a patentee with one idea—such a patent as a mere patent agent likes—the patent is cheapened, but to the fertile inventor it is a heavily-increased tax.

There are many more points to consider, but let us begin at the beginning.

A patent monopoly is granted in the supposition of something *new* and useful to the community.

What is new?—"Nothing under the sun." The globe and its materials and modifications date from the creation. What is old or new must be dealt with as a matter of possession. The law says that land out of ownership for thirty years becomes the property of anyone who can squat thereon. The same rule might very well apply to inventions. Anything out of use for thirty years should be considered as practically extinct. The last French recommendation on patents considers ten years' abandonment as an equivalent to non-existence. With the publication of all the patents, a datum line becomes important. If a man with a useful idea, new to him, examines the lists, he will probably discover that it has been patented before, and he abandons it. In this mode the very publication might become an evil to the community, by narrowing the sphere of action. With the recognition as new of all things out of use for thirty years, the Patent Acts may become very valuable "diggins" for inventors, and very advantageous to the public.

The next question is, the process of granting, whether by previous examination, or at the patentee's own risk. I incline to the latter, for the purpose of preventing all imputation of unfairness in what is supposed to be a secret. But after specification, the patent, or such parts of it as were infringements of previous patents, should be, with notice to the pseudo-patentee, struck off the lists by judges, giving, not their opinions, but their several and joint reasons for so doing.

The cost of the patent, it is clear, should only bear a reference to covering office expenses and the business of publishing. To deny a man the benefit of his own brains on account of his poverty, is a great injustice; and the talk of overlaying the office with rubbish, by reason of cheap patents, becomes void of meaning, if a cheap provision for abolition is made, to get rid of the absurd *scire facias*, an instrument only useful to oppressive people.

With regard to litigation, it is clear that a special Board is required to settle disputed claims. But there is one obvious means of preventing injustice. In case of complaint of infringement, let the complainers be bound to state and advertise their case in the public press, and their intention of applying to the Board of Judges. Let the witnesses be called by the Court, at the instance of the litigants, and paid by the Court, for it is a public as well as a private interest that is at stake. And in case of a manifest injustice, let the ill-doer be saddled with all the expenses. And in case of a wealthy company seeking to oppress a poor man or individual, it should be competent for the Court to amerce in heavy damages, payable to the individual and to the Office.

With regard to the payment of witnesses, as the public is a party to the dispute, the public should pay them, *i e.* out of the funds of the Office. There are two classes of witnesses—those as to facts, and those as to principles, and there is no reason why they should not be put into the category of an ordinary subpœna. It is a mere mockery of justice for a rich man or company to give high retaining fees to men in position, and debar the poor man of his chance of redress.

The advisable duration of a patent is another question, and also the question of paying fees.

The French report advises a patent for forty years, and a small annual payment, to be collected by the tax-gatherer, so that a man may abandon his patent when he likes. They propose also to give him the exclusive use for 15 years, but to make it compulsory on him to take payment from any one wishing to use it, after that period, of a regulated royalty.

Probably it would be well to classify patents, with this object. The higher class, involving a novel and important idea; and the lower class, involving mere contrivances or manufactures. The former class gets but slowly into use; the latter, more rapidly.

The character of mind of an inventor—and they are not a numerous class—is sometimes crotchetty. Frequently he prevents his own prosperity. But not on that account must we forget that he is a benefactor to the community, and while providing that he should not shut up an invention, we must take care that he be compensated. And it would not be an unworthy use of surplus funds from patent fees to devote a part of them to help unfortunate men who have done the state service.

It is supposed that the surplus is enormous, and many eyes are fixed on it for their owner's own purposes. One purpose seems less objectionable than others—providing for men of science upon whose discoveries many patents have been based. But there is more apparent than real logic here. The true plan is to give the man of science his patent also for his discoveries, and we know that many men of science do so work their brains. Science proper can find many means, in writing books, and it would be very proper to give the first discoverer of a star the sole privilege of publication respecting it for a given time. A geologist or geographer, or discoverer of new land, might also be thus compensated. The first promulgator of new knowledge would have a very enviable practice. What would be the value of the principle of circle sailing to the original discoverer, if all subsequent writers were compelled to pay him toll, or the State to buy him off? If Professor Owen were entitled to a royalty upon all books containing allusions to his discoveries, he probably would be well off. And if Faraday held the right of his scientific discoveries, he might, perhaps, be on a level with railway contractors.

The French report recommends the grant of patents for new financial plans.

Assuming, then, that the Patent Office is established for the benefit of the general community through the agency of inventions, the requirements are as follows:—

First. The publication of all past and present patents of all countries, with translations from the foreign.

Secondly. A public library, accessible to inventors at all reasonable hours, containing all works having reference to invention.

Thirdly. An assortment of models of all complicated machinery.

Fourthly. The right to a patent when applied for at the inventor's own risk.

Fifthly. The right to be informed, where practicable, that his patent will not be valid, but leaving the taking it to his own option.

Sixthly. A board of judges, or examiners, to strike off the list all such patents, or parts of them, as, when specified, are manifest infringements, or duplicates, with notice to the patentee, thus clearing the office of superfluous matter.

Seventhly. A board of judges to decide on litigated patents, and to subpœna witnesses at the cost of the office, the office bearing the expense out of the accruing funds, on the ground that the patentees have contributed them, and the question belongs to the public as well as to the individual.

Eighthly. That the board shall have the power of amercing oppressive companies or individuals, to compensate the individual and the office.

Ninthly. That every complainant shall publish his statement in the public press for a certain time previous to the decision by the board.

Tenthly. That a patent should apply to all new discoveries in science, and to all arts, manufactures, or inventions not known for thirty years past to be in use, whatever records may exist of them. That in case of discoveries involving the application of principles not before used, the duration of the patent shall date from its first profitable use.

Eleventhly. That the cost of a patent should be determined by the amount of money required to pay the salary of the officers, judges, and publishing establishment, library, &c., and should be raised or lowered from time to time as they might become more or less numerous.

Twelfthly. That the provisional specification be kept secret till the patent be sealed and the full specification lodged.

Thirteenthly. That in case of patentees with similar titles closely following each other, the second should be allowed such extended time for his specification as will enable him to examine the previous one.

Fourteenthly. That the duration should be extended in corresponding ratio from the date of the specification.

The tendency of the age is now to work patents by companies, and the tendency for those companies to oppress individuals, because all law expenses fall lightly on the companies and heavily on the individuals. And this tendency will decrease the progress of invention unless guarded against. In France, invention dates from the first grant of patents by the elder Napoleon. Before that, French invention scarcely existed as a public matter. It has been remarked also, that with the increase of patents in England there has been a decrease of litigation. This may arise from two sources, first, that the publication of patents has prevented mystery; secondly, that litigation is so hopeless that people abandon their right, rather than contest them.

Such laws are a practical denial of justice. Let us either abolish patents altogether and stop invention, or make simple justice a plain and easy thing for the inventor. He pays himself enough taxes to support all the tribunals he requires, and to that purpose should the surplus fairly be devoted. It is believed that the Chancellor and the present Law Officers of the Patent Office would support such a plain system of Patent Law Reform, if it were only fairly placed before them. It would be a proud day for England thus to take the lead in rendering tardy justice to the men who ever labour for the progress of humanity.

I am, Sir, yours faithfully,

W. BRIDGES ADAMS.

MR. HAWES AND THE PATENT LAW.

SIR,—Mr. Hawes, in his paper on soap, last night, commenced with a list of "Patents," beginning in 1622, tending to oppose the soap trade. It would have been quite as candid to state that these were not patents in the modern sense of the term—a monopoly of an improvement—but simply monopolies of a whole trade, granted by despotic power to convenient tax-payers.

Ex-cathedra condemnation of patents and patentees is made suddenly to emerge from a discourse on soap. Mr. Hawes pleasantly assumes, with a patronising look of kindness, that patentees foolishly stand in their own light "by not relying upon their own knowledge and skill for success," and that patents are equally injurious both to them and to the public.

I think it will be found that the opponents of patents are always people in easy positions of business or employment, or capitalists contented with moderate interest in very secure investments. "Let well alone, for *we* are very well off." Their doctrine comes under the category of preaching general contentment to the poor. The excessive desire to save inventors from injuring themselves, so commonly professed by patent opposers, does certainly savour of over-philanthropy.

Mr. Hawes makes it an imputation on patentees, that capital has been found to take the patents by "persons out of business, and unacquainted with the real state of the case." Mr. Hawes assumes that all the soap patentees but one have been quacks and pretenders, who would not "seek information from those able to afford it," viz., the trade. But how can all this damage the trade or the public? Who is made to suffer, save the quack patentee and his dupes?

Very fortunately for the world, Mr. Hawes is, indeed, in a large and increasing minority in his opposition to patents. The state reports from both France and the United States, both regard inventors as benefactors to the world, and deserving of more help and protection than they have yet received.

Men of science, of genius, and skill, like patents. Dr. Brewster patented his kaleidoscope; Liebig patents manure; Schonbein patents gun-cotton; Watt and Arkwright have been succeeded by numerous others; and in our own day we have George Stephenson and his son Robert, the Maudslays, Penns, Fairbairns, Muntzes, Mackintoshes, and others. In short, every man of genius is desirous to reap the fruit of his own brains in the form of a patent, and even wealthy noblemen do not disdain it.

The "protection of restrictive laws," says Mr. Hawes, "is a snare and a delusion." This kind of wording is a delusion. A patent for what never existed cannot restrict, and the snare is to be found only in the miserable condition of the Patent Law. It is the class of argument which objects to cheap law, and denies people justice, lest it should make them litigious.

The good easy class of people, who belong to large companies, or hold practical business monopolies, cared little about patents till limited partnership came to the aid of the patentees, to place them on a level with their brethren in France and the United States. They then took the alarm, and Lord Overstone and Mr. Glyn are samples of the class opposition which still makes the Limited Liability Act almost a dead letter.

In truth, it is the great struggle between power in possession and power out of possession. The former is incessantly striving to build up barriers to keep the stronger intellects that may push the occupants from their stools. Business people do not object to patents, provided they possess them. Every business man likes a monopoly if he can get it. When the electric telegraph was first made practicable, a company, being as they thought a monopoly, bought the invention for a large sum; subsequent patents they bought up, and bullied the owners of others according to law. But it was unavailing, and the chairman of the company, by his evidence, sought to overthrow the patent laws altogether, alleging them to be a mischief to all parties. And, viewed from his monopoly-desiring side of the question he was right. Without patent protection for invention, no inventor would have tried to supersede the company's plans, and they would have retained a monopoly. Neither magnetic nor any other telegraph would have appeared in opposition.

Other companies, treading in their footsteps, are trying to do the same thing. Patent-mongering is the order of the day, and the whole system of railways appears destined to be overwhelmed by it. If we take up a railway journal we find a patent permanent-way company, a patent axle-box company, a patent switch and crossing company, and, no doubt, we shall have a patent locomotive and a waggon company in due time. Inventors, if poor, find themselves "cabined, cribbed, confined," and driven into the open jaws of the patent mongers. Limited liability tends to defeat this, for the individual with the improved plan, put upon equal terms, will infallibly beat the company with the inferior plan. This the grand company does not like, and, with Lord Overstone and Mr. Glyn at their head, want to sap the Limited Liability Act and cut short the capital. It is the old story of rival tradesmen, the large capitalist seeking to ruin the small one.

At this particular time the world rings with complaints of the evils of competition carried to excess, because the intellect of buyers from government claimants is competent to know that four is less than five, but not that four is worse than five, so low price carries all before it, inferiority included. Now patented improvements are precisely calculated to give the remedy for this; emulous patentees will not damage their respective inventions by inferiority because they are not competed with to the mischievous extent. Patents are valuable both to the inventor and to the public, in the same way that land becomes more valuable to the individual and the public, by dividing into farms. Instead of fallow common it becomes cultivated fields, but which no one will cultivate without the right to the usufruct.

There is a deeper depth yet into which the capitalists will be wise to look ere they try to prevent the expansion of genius. The holders of land, and house, and factory, and mine, and forest, and the precious metals, say in their heart, like the fool in Scripture, "We have and will keep all we have got of material wealth, and will make common stock of the brains by which it is rendered useful." But give them their will—take away patents in England—and the inventive men of genius will flock to France and the United States, leaving the men of capital to compete with each other, and with an improving external world, till they have eaten one another up. And if America and France were to do the same thing, the inventive men will seek to civilise the Russians and other savages, who do, at any rate, appreciate genius exercised for destruction. Or it may be, that the men of genius, deprived of the legitimate use of their brains and their property in them, to use them as a means of rising in the social scale, will begin to inquire very curiously as to what right the present holders have to the existing material wealth of the world; why it should not be divided, share and share alike, like the brains? A revolution of a novel kind would be the result of this. It would be socialism on a grand scale.

Patents for *things* are but another version of copyright in books, and they are part and parcel of the great safety-valve that keeps the world quiet by holding out hope to the energetic. Without patents, every engineer on a railway, every master of a factory, would make mind his helot; invention would be done to order, or not done at all, as the farmer breaks the eggs of the game he is not allowed to shoot. Emulation would be at a stand-still, and tyranny rampant. Unscrupulous chiefs would purloin and appropriate the brains of individuals when no record existed to tell the tale; and the genius of a Watt subordinated to a quack, would be rewarded with 40s. or £5 as compensation for the loss of his birthright. The eternal laws of God are opposed to this wholesale robbery, and vain and fruitless are all attempts to hedge in this cuckoo of a would-be general monopoly, keeping back progress in order that the existing vested interests may continue to draw the first prizes to the exclusion of other aspirants.

JETHRO PYM.

DECIMAL COINAGE—THE PENNY SYSTEM.

Sir,—In Friday's *Journal*, Mr. Minasi shows, from a work published about 200 years ago, that but one out of twenty cases of exchange with foreign cities was effected with the pound sterling as the standard. The case is greatly altered now, as may be seen by reference to any number of the *Times*. Thus, in last Friday's "Course of Exchange," the pound sterling is the standard in eleven instances, while England gives pence for foreign coins in only nine.

I remain, Sir, yours obediently,
S. A. GOOD.

Pembroke Dock, March, 24, 1856.

MEETINGS FOR THE ENSUING WEEK.

Mon. Actuaries, 7.
London Inst., 7, Dr. Lankester, "On the Recent Progress of Vegetable Physiology."
Architects, 8, Mr. T. L. Donaldson, "On the Triumphal Arches of the Romans."
Chemical, 8.
Tues. Royal Inst., 3.
Civil Engineers, 8, Mr. C. R. Drysdale, "On Steep Gradients of Railways, and the Locomotives Employed."
Linnean, 8.
Pathological, 8.
Wed. London Inst., 3, Prof. Rymer Jones, "On Entomology and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Prof. Willis, "Description of Improved Apparatus for Teaching Mechanics in Schools."
Pharmaceutical, 8.
Thurs. Royal Inst., 3.
Zoological, 3.
Antiquaries, 8.
Photographic, 8.
Royal, 8½.
Fri. Botanical, 8.
Royal Inst., 8½.
Sat. Asiatic, 2.
London Inst., 3, Mr. E. W. Brayley, "On Geology."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette March* 21*st*, 1856.]

Dated 20*th February*, 1856.

436. David Auld and John Stephen, Glasgow—Improvements in steam boilers and furnaces, and in apparatus connected therewith, and in the consumption or prevention of smoke.

Dated 22*nd February*, 1856.

458. William Strang, Glasgow—Improvements in ornamental weaving.

Dated 26*th February*, 1856.

475. Bennett Johns Heywood, Dublin—Improved holder for leads, slate, and other marking materials, applicable also as a case for other articles.
477. Joshua Murgatroyd, Heaton Norris—Improvements in steam boilers.
479. Charles Iles, Birmingham—Improvements in pointing hair pins, and in making up hair pins for sale.
483. Joseph Marzolo, Padua—An impressible mechanism, reproductive of movements, and applicable to weaving and other looms, and for industrial purposes.

Dated 26*th February*, 1856.

485. John Barrow, jun., Manchester—Improvements in the manufacture of soda, sulphurous and sulphuric acids, carbonic acid, chlorine and muriatic acid, and apparatus used therein.
487. Samuel Henn and Thomas Haddon, Gibb-street Works, Birmingham—Improvements in the mode or modes of forming or making the heads of ornamental nails, when such heads are formed of a different metal or metals from the shanks of the same.
488. George Coats, Glasgow—Improvements in partitions or "brattices" for coal mines and other underground works.
489. Fernand Rodolphe Penor, Darmstadt—Improvements in looms for weaving. (A communication.)
491. John Cornes, Swan-lane—Improvements in machines for washing and churning.
493. Francis Thompson, Sheffield—Improvement in skates.
495. George Parry, Ebbw Vale Iron Works, Monmouth—Improvement in the puddling and refining of iron.
497. George Tomlinson Bousfield, Sussex-place, Loughboro'-road, Brixton—Improvements in power looms. (A communication.)

Dated 27*th February*, 1856.

499. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—A new cicatrising preparation. (A communication.)
503. Edward Ellis Allen, 376, Strand—Improvements in the permanent way of railways.
505. Thomas Taylorson Jopling, Bishop's Wearmouth—Improved construction of water meter.

Dated 28*th February*, 1856.

507. William Thompson and Charles Wilson, Birmingham—Improvements in buttons, and in attaching the same to articles of dress.
509. Isaac Westhorp, London—Improvements in concentrating milk, and in obtaining concentrated extracts from tea, coffee, and chocolate. (A communication.)
511. Charles Frow, Wakefield—Improvements in furnaces for steam boilers and other purposes.
513. Elisha Thomas Archer, Cedar-cottage, Wandsworth—Improvements in envelopes for the transmission of letters or parcels.
515. Pierre Louis Grosrenaud, St. Etienne—Improvements in apparatus or furnaces for melting and puddling metals.

Dated 29*th February*, 1856.

517. James Logan, Liverpool—Improvements in pumps, which improvements are especially applicable to bilge pumps on board ships and steam vessels.
519. John Markett, Lieut., R.N., Hastings—Improvements in the manufacture of envelopes.
521. John Greenwood, Rawden, near Leeds—Improvements in heating water for the supply of steam boilers.
523. Charles Barlow, 89, Chancery-lane—Improvements in machinery for cutting cloth and other textile fabrics. (A communication.)

Dated March 1*st*, 1856.

527. Robert Frederick Miller, Hammersmith—Improved omnibus.
529. Henry Andrew Dewar, Aberdeen—Improvements in conveying or transmitting motion for effecting mechanical operations.
531. Paul Rapsey Hodge, 4, Albion-grove, Islington—Improvements in the method of lighting domestic fires.
533. Alfred Francis, Encomb-terrace, Wandsworth-road—Improvements in the manufacture of a composition applicable as a cement or plaster, and to other purposes.
535. Cyprien Marie Tessié du Motay, 24, Rue Fontaine St. George, Paris, and Jean Jacques Fontaine, 19, Rue Paradis-Poissonnière, Paris—Improvements in treating cast-iron.

Dated 3*rd March*, 1856.

539. Adolphus Oppenheimer, Manchester—Improvements in machinery or apparatus for stretching or distending velvets and other piled goods or fabrics, for the purpose of cutting the pile of such goods.
541. Julius Homan, Milk-street, Cheapside—Improved mode of driving sewing machines.
543. John Edward Hodges, Leicester—Improvements in machinery for the manufacture of looped and textile fabrics.
545. John Edward Hodges, Leicester—Improvements in machinery for the manufacture of looped fabrics.

Dated 4*th March*, 1856.

547. Louis Coddé, M.D., 39, Rue de l'Echiquier, Paris—A system of submarine communication.
549. Thomas Lambert, New Cut, Lambeth—Improvements in apparatus for regulating the drawing off of water and other fluids.
551. Martin Samuelson, Scott-street, Hull—Improvements in screw propellers.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3820	March 20.	Heap's Improved Pipe and Nut Wrench	William Heap	Oldham-road, Ashton-under-Lyne.
3821	March 25.	An Improved Grate, for Heating, Ventilating, and Economising Coals	Frederick Cornwall	Hanley-street, Birmingham.

Journal of the Society of Arts.

FRIDAY, APRIL 4, 1856.

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EXAMINATIONS FOR CANDIDATES FROM INSTITUTIONS ASSOCIATED WITH THE SOCIETY OF ARTS.

Some additions having been made to the following statement, it is considered advisable to republish it for the information of the Institutions. A broadsheet, for suspension in the Institutions, and smaller copies for distribution, have been sent round to each Institution in Union. A copy of the declaration of confidence in this movement, signed by a large number of employers of labour, in all parts of the kingdom, and in every branch of industry, stating that they are prepared to regard as testimonials worthy of credit the certificates of the Society, has also been sent. It is particularly requested that the Declaration be suspended under the broadsheet:—

NAMES OF THE EXAMINERS.	SUBJECTS.	SUBDIVISIONS, TEXT BOOKS, AND LIMITS.
Mr. Ball Rev. Dr. Booth, F.R.S. Mr. Glaisher, F.R.S. Mr. J. G. Jay	MATHEMATICS	Arithmetic, Book-keeping, Algebra, Euclid, Mensuration. Barnard Smith's Arithmetic (*Bell and Daldy*), or Colenso's Arithmetic (*Longmans*) to end of Proportion. Book-keeping by Double Entry, Irish School Series (*Groombridge*). Colenso's Algebra (*Longmans*), to end of Quadratic Equations. Euclid, books I., II., III. Tate's Mensuration (*Longmans*), or Mensuration, Irish School Series (*Groombridge*), Kelly's Elements of Book-keeping (*Simpkin and Co.*), Morrison's System of Book-keeping (*Griffin*).
Rev. Dr. Booth, F.R.S. Mr. C. Brooke, M.A., F.R.S. Professor Goodeve, M.A. Rev. Bath Power, M.A.	MECHANICS	Statics. The Principles of Mechanism and their Application to Simple Machines, to the Steam Engine, &c. Fowler's Mechanics (*National Society*). Galbraith and Haughtons' Manual of Mechanics (*Longmans*). Lardner's Hand-book of Mechanics (*Walton and Maberly*). Bird and Brooke's Elements of Physics (*Churchill*).
Professor Solly, F.R.S. Dr. Stenhouse, F.R.S.	CHEMISTRY	Organic and Inorganic. Wilson's Chemistry (*Chambers' Educational Course*). Fownes's Manual of Chemistry (*Churchill*).
Dr. W. B. Carpenter, F.R.S. Dr. Bence Jones, F.R.S.	PHYSIOLOGY	Carpenter's Manual (*Churchill*). Dr. Southwood Smith's Physiology of Health (*Charles Knight*).
Dr. W. B. Carpenter, F.R.S. Professor Henfrey, F.R.S.	BOTANY	General Structure, and Systematic Botany. Lindley's School Botany (*Longmans*). Flowers of the Field, by Rev. C. Johns (*Christian Knowledge Society*). Henfrey's Rudiments of Botany (*Van Voorst*).
Mr. James Caird Mr. J. C. Morton	AGRICULTURE	Such a General Knowledge of Farm Practice and of the Management of Live Stock as must to some extent, at any rate, have been obtained in the Field. Low's Elementary Agriculture (*Longmans*), Johnston's Agricultural Chemistry (*Blackwood*), Mr. Pusey's Papers on the Progress of Agricultural Knowledge, in the 26th No. of the Royal Agricultural Society's Journal.
Rev. Dr. Booth, F.R.S. Rev. S. Clark Dean of Hereford	GEOGRAPHY	Political and Physical. Cornwell's School Geography (*Simpkin and Co.*) Sullivan's Geography, Irish School Series (*Groombridge*). Milner's Geography (*Tract Soc.*) Guyot's Earth and Man (*Parker*). Mrs. Somerville's Physical Geography (*John Murray*). W. Hughes' Physical Geography (*Longmans*). School Physical Atlas (*Keith Johnston*, or *National Society*).
Professor Brewer Rev. F. Temple	ENGLISH HISTORY.	Ince's Outlines of English History (*Gilbert*). A more extensive knowledge of the following reigns:—Alfred, William I., John, Henry VIII., Elizabeth, and the Stuarts to the end of the reign of Anne.
Professor Brewer Rev. Dr. Elder Rev. W. Elliott Rev. F. Temple	ENGLISH LITERATURE: ENGLISH COMPOSITION: WRITING FROM DICTATION	Bromby's English Grammar (*Simpkin and Co.*) Chaucer's Prologue to the Canterbury Tales. Spenser's Fairy Queen, First Book. Shakespeare: King John, Henry IV., Henry V., Lear, Hamlet, Macbeth, Othello. Bacon: First Book of the Novum Organum; the Preface, Fifth and Seventh Books of the Advancement of Learning. Milton's Paradise Lost. Dryden: Virgil's Æneid, Six Books. Spectator. Pope: Poetical Works. Butler's Analogy. Wordsworth: Excursion, or Lyrical Ballads. Tennyson. *Candidates may take up any two authors of the above.*
Professor Browne Mr. Sandford	ROMAN HISTORY: LATIN	To end of Punic Wars, or from that date to the death of Aug. Cæsar. Dawson Turner's Outlines of Roman History (*Parker*). Cæsar, First Book. Sallust, Jugurthine War.
Professor Brasseur	FRENCH	Grandeur et Décadence des Romains, par Montesquieu, jusqu'à la fin du Chap. II. La Henriade, jusqu'à la fin du Chant II.
Dr. Bernays	GERMAN	Treue bis in den Tod, by Nieritz. Schiller's Jungfrau von Orleans.
Mr. John Bell and Mr. F. S. Cary.	FREE HAND DRAWING IN OUTLINE FROM OBJECTS.	

RULES.

The Examinations will commence at 10 A.M., on Tuesday, the 10th of June, 1856, at the Society's House in the Adelphi.

Candidates who propose to offer themselves for Examination, must give written notice of their intention to the Secretary before the 31st of May, 1856. Each Candidate must state, the Institution to which he belongs, his age, his employment, and by whom employed, and the subjects in which he desires to be examined.

All Candidates will be required to possess a competent knowledge of Writing and Spelling.

⁂ The Examiners define good writing as a bold hand in which *all* the letters are distinctly and completely formed.

Every Candidate will be expected to come prepared in two subjects (not subdivisions of subjects) at least.

The Examiners in *Science* merely recommend the text-books set down. They will be prepared to recognise knowledge however obtained.

The Examination will be conducted by written papers and by oral examination.

The Examiners will award Certificates of Three Classes.

First Class Certificates will be awarded only to a high degree of excellence.

Should the proposed Examinations receive the approbation and support of those classes for whose benefit they are undertaken—employers and candidates for employment—the Council of the Society of Arts will be prepared to take into their consideration the própriety of extending the advantages of the system to the more remote parts of the country.

PRIZES FOR 1856.

Mr. R. Stephenson, M.P., Vice President of the Society of Arts, has placed Ten Guineas at the disposal of the Council, who have determined to award it to the Candidate who shall pass the best examination in Mathematics and Mechanics, and obtain a First-class Certificate in each.

Mr. George F. Wilson, F.R.S., gives a prize of Ten Guineas, to be awarded to the Candidate who shall pass the best examination in Chemistry, and obtain a First-class Certificate therein.

Mr. Mechi gives a prize of Ten Guineas, to be awarded to the Candidate who shall pass the best examination in the Principles of Agriculture, and obtain a First-class Certificate therein.

Mr. Samuel Morley has placed Ten Guineas at the disposal of the Council, who have determined to award it to the Candidate who shall pass the best examination in Physical Geography, and obtain a First-class Certificate therein.

Mr. Charles Wentworth Dilke, Vice President of the Society of Arts, gives a prize of Ten Guineas, to be awarded to the Candidate who shall pass the best examination in English History, and obtain a First-class Certificate therein.

Mr. G. N. Hooper gives a prize of Ten Guineas, to be awarded to the Candidate who shall pass the best examination in French, and obtain a First-class Certificate therein.

Mr. Peter Graham gives a prize of Ten Guineas, to be awarded to the Candidate who shall exhibit the greatest proficiency in Free Drawing in Outline, and obtain a First-class Certificate therein.

Mr. John Wood, the Chairman of the Board of Inland Revenue, has placed two appointments *annually*, in the Surveying Department of the Excise, at the disposal of the Council of the Society of Arts.* No Candidate will be recommended for these appointments who shall not obtain *Second-class Certificates, at least*, in Mathematics, Chemistry, English Composition, and Writing from Dictation.

The Society of Arts will give a prize of Twenty-five Guineas to that Candidate who shall be recommended to the Council by the Board of Examiners for General Excellence in the Examinations.

By order,

P. LE NEVE FOSTER, Secretary.

Society's House, Adelphi, London, March 22, 1856.

SIR JOHN HERSCHEL AND THE SOCIETY OF ARTS EXAMINATIONS.

The following letter has been addressed by Sir J. Herschel to the Chairman of Council:—

"Collingwood, March 19.

"Sir,—I cannot have the smallest objection to stating the grounds on which I have subscribed to the declaration of confidence in the certificates of proficiency about to be awarded by the Society of Arts to the young men who offer themselves for examination as proposed in the circular accompanying it. It cannot but be of very great importance to those who have situations to fill up in the several departments of active life to obtain a knowledge, independent of the partial opinions of recommending friends, of the positive qualifications of the young persons who may offer themselves as candidates for such situations, in the immense majority of cases when such tests of merit as university honours or distinctions of a similar kind are out of the question. This is a want on the part of the public as yet unsupplied, and the example of what is being attempted in the departments of the civil as well as military service of the country may, I think, very advantageously be followed in commercial and industrial pursuits of a private nature, and I think the Society of Arts, by volunteering the initiative in undertaking this duty, is doing good service to the country. My confidence in the fairness and impartiality of the awards is based on the publicity of the whole proceeding, on the high character of the Society, and on the list of examiners, which comprises many names which I consider as guarantees for the rectitude and uprightness of their awards, and for the reasonable conduct of the examinations themselves in reference to the objects to be attained.

"I have the honour to be, Sir,

"Your obedient servant,

"J. F. W. HERSCHEL.

"The Rev. J. Booth, Chairman of the Council
of the Society of Arts."

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* The following are the rules laid down by the Commissioners with respect to the qualifications of candidates for admission into the surveying branch of the Revenue:—

The candidate must, on entering the service, be not less than nineteen, nor more than twenty-five years of age. A baptismal certificate, or other satisfactory evidence, will be required.

He must be healthy and active, and without any bodily infirmity. Of this a medical certificate will be required.

He must not be encumbered with debts; and must be unmarried, and without family, and of respectable character; and he will not be allowed to marry until he attains the rank of ride officer.

He must understand arithmetic, so as to work out sums in the rules of addition, subtraction, multiplication, and division, both in common arithmetic and in vulgar and decimal fractions, reduction, proportion, practice, and interest. He must be able to write a good hand, and correctly and fluently from dictation; and have a competent knowledge of book-keeping by double entry.

He will undergo an examination in the above-named subjects, and if approved will be placed under the instruction of an Excise officer for at least six weeks; at the expiration of which period, if he be found qualified to perform the duty of an officer, he will be certified for accordingly, and his salary will commence.

CLASS BOOKS FOR INSTITUTES.

The Council have much pleasure in publishing the following letter:—

Committee of Council on Education,
Council-office, Downing-street, London,
March 25th, 1856.

SIR,—In reply to your letter of the 26th December, 1855, and to a further letter of the 22nd ult., explaining the object of a deputation from the Council of the Society of Arts, which had waited upon the Lord President, to pray that the evening classes of Mechanics' Institutes, when such classes were of a scholastic character, might be allowed to obtain books and apparatus, through the Committee of Council, upon the same terms as schools under inspection, I am directed by the Lord President to state that, he is prepared to allow such classes to have the privilege of purchasing the books and apparatus which, for the time being, may be upon the lists issued by the Committee of Council, through the agency established by their lordships, if the members find it to be for their advantage to do so.

The secretary of the Institute should, in each case, correspond directly with the Committee of Council, but with the application he should file a certificate from yourself, stating that the Institute is in union with the Society of Arts, and that the Council of the Society recommends its application.

It is understood that no classes will be recommended to the Committee of Council except those in which regular instruction is the characteristic feature; that the classes will be open to the visits of her Majesty's Inspectors; that, if scientific apparatus be applied for, a competent lecturer will be engaged, *i.e.*, that the class will not depend for its scientific instruction upon itinerant lecturers alone; lastly, that the premises and furniture will be reasonably convenient for the purpose.

The lists, both of elementary school books and of scientific apparatus, are at this time undergoing revision, for the purpose of being greatly extended.

The forms in use will also require to be slightly modified, to suit applications from the classes in question.

The revision of the lists is a work of great labour, and will not, probably, be completed for some considerable time.

It would not be advisable to admit a new class of cases until the new lists are completed and in use. The old lists would much more restrict the power of selection.

I am, therefore, to request that, at present, no steps be taken by the Council of the Society upon this letter. As soon as the lists are completed, the Lord President will cause you to be informed that the Committee is prepared to receive applications.

I have the honour to be, Sir,
Your obedient servant,
R. R. W. LINGEN.

UNION OF COLONIAL INSTITUTIONS.

MEETING OF COUNCIL, 2ND APRIL, 1856.

At the meeting of Council held on the 2nd inst., a letter was read from the Secretary to the Fredericton Athenæum, accompanied with the subjoined extract from Minutes and Report of a Committee, requesting that that Institution might be taken into Union with the Society of Arts on the basis of the terms laid down by the Council on the 19th of December, 1855, and published in the *Journal* of the 21st of the same month, when it was

Resolved—That the Fredericton Athenæum be taken into Union, in accordance with the Resolution of the Council of 19th December, 1855.

King's College, Fredericton, Jan. 28, 1856.

At a meeting of the Fredericton Athenæum, held in the College Library, Jan. 28, the Hon. Chief Justice Carter, the President, in the Chair, the Secretary informed the Society that he had received by mail from England, No.161, vol. iv., of the *Journal of the Society of Arts*; that the said Journal contained an announcement from the Society of Arts (which was read) signifying that they desired to connect themselves more closely with Colonial Institutions, &c. Whereupon, on motion, the subject was referred to a select committee, consisting of Dr. Jack, Professor of Mathematics and Natural Philosophy, J. Wilkinson, C.E., and Dr. Robb, Professor of Chemistry and Natural History in King's College.

On Feb. 25th Dr. Robb, on behalf of the committee, submitted the following Report upon the subject above referred to, and which Report was unanimously adopted: The Secretary was, moreover, instructed to carry out the views expressed in the Report, and to correspond, when required, with the Secretary of the Society of Arts:—

REPORT.

The committee appointed at the January meeting to report upon the proposed connection with the London Society of Arts, beg to state that they have given the subject consideration, and would now recommend that the offer of connection of the Fredericton Athenæum with the Society of Arts be thankfully accepted, upon the terms proposed in the letter.

These terms are, the annual payment of two guineas to the said Society of Arts; and the return, therefore, may be stated as follows:—

1. This connection brings the colony and colonial institutions into a more near and friendly connection with the parent state.

2. It brings a young and willing Society into contact with one thoroughly established in the confidence of the world; one which is both able and desirous to direct the path of young colonial institutions into the most useful and practical course of operations.

3. It permits of the purchase of books and apparatus in London on the most favourable terms. Although the Athenæum has not done anything in this way as yet, the proposed connection may lead to a revisal of our present plan, whereby the Society may be made more directly useful.

4. It gives position and advantages to such of our members as may be in London in the course of the year.

5. It entitles us to a copy of the valuable Journal of the Society, now published once a week, and which would otherwise be charged 17s. 4d. per annum.

This may lead to our taking other journals.

6. Although the Fredericton Athenæum has deviated, somewhat unavoidably, from its original plan, which was more especially limited to provincial objects, and has now become rather a literary than a scientific association; and, although for the reasons just alleged, it may be little able to contribute to the advancement of science or art by the efforts of its members, nevertheless, the Fredericton Athenæum deems it an honour to be permitted to aid in any way in carrying out the applications of science to art, and the beneficent designs contemplated by the London Society for the Encouragement of Arts, Manufactures, and Commerce. Respectfully submitted.

(Signed) J. ROBB,
W. B. JACK,
J. WILKINSON. } Committee.

SIXTEENTH ORDINARY MEETING.

Wednesday, April 2nd, 1856.

The Sixteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 2nd inst., Sir John Rennie, F.R.S., in the chair.

The following Candidates were balloted for and duly elected Ordinary Members:—

Batt, Henry
Kaye, Horace
Lester, Lester
Lyte, F. Maxwell

The following Institution has been taken into Union since the last announcement:—

412. Haley Hill (near Halifax), Working Man's College.

The lecture delivered was

ON IMPROVED APPARATUS FOR TEACHING MECHANICS IN SCHOOLS.

By the Rev. Professor Willis, F.R.S.

The Professor said he proposed to give a short account of the experiments that he had for a long time past been fighting with, upon apparently trivial purposes and with perhaps small results. But it was probably known to many persons that circumstances had placed him in a double position, and that most of these things were done by those whom accident had placed in such a position, viz., that all his life, from his boyhood, he had been in the practice of constructing various kinds of mechanical apparatus. He had always been fond of carpentering, and work of that sort, and had followed up that bent of his inclination; at the same time fortune enabled him to obtain the advantages of a university education—that is, an education in the higher branches of mechanical science—and, therefore, by a fortunate concurrence of these two circumstances, he might have some little claim for being able to make some improvements in the apparatus commonly employed to illustrate that science. He had always been in the habit of constructing his own apparatus for the illustration of the subjects he had been accustomed to lecture upon. He did not mean to say that he could cut down a tree, saw it into planks, and plane them up; but what he meant was, he employed workmen to construct from his own design, in separate pieces, which separate pieces he put together himself in the carrying out of that design; and by this means he had succeeded in reducing to a practical shape many of those things for which people for the most part were principally dependent upon the mathematical instrument maker. He might here be allowed to express the hope that many mathematical instrument makers had attended that evening; he begged of them to copy and make what use they liked of what he might bring before them, provided they would mention the source from whence they derived their hints, trifling though they might be. He might mention at the outset that, some time since, he had the honour of receiving a commission from the Board of Trade, to pay some attention to the construction of a better sort of apparatus for the purpose of illustrating the elementary principles of the mechanical sciences, than that which had hitherto been employed in the ordinary schools throughout the country, and it was for that reason, perhaps, that he had been induced to bring this subject so prominently before the Society, and that might be an apology for the exhibition of the many things which were arranged on the table before him. He was not going to propound the question whether Archimedes ever lectured or made any apparatus to illustrate his views, but he was speaking now of apparatus which was suited to the lecture-room and to the lecturer, for the illustration of the subject of which he treated. We knew, from the earliest history of science, that there had always existed two kinds of mechanical or investigating philosophers: One class of these was so highly gifted with the power of reasoning, that when they applied reasoning from deductions that arose from natural philosophy, they were so content with the deductions they arrived at, that they did not take the trouble to try whether in practice they were correct. He had no doubt that the philosopher who discovered that if a certain weight was suspended from the short arm of a lever, and half that weight was suspended upon an arm of the lever twice the length of the other, they would balance. No doubt, he said, that philosopher never tried that experiment at all, but if he had been told by some friend that it answered very admirably, the philosopher would have replied, "I thank you; I knew very well that such would be the case, although I admit I never troubled myself to try it." That was one class of philosophers: It was because their convictions were so strong that they never tried whether they were practically true. But there was another class, who delighted in trying the results of their deductions, and amused themselves with the most complex results, all of which they could account for most thoroughly. Perhaps it might not be too much for him to say that he considered himself as belonging to the latter class. He had always delighted in making experiments in mechanical science, and putting the results into a shape to be easily intelligible, for it was manifest that those who had gone through a mathematical education investigated by pure reasoning and trusted to it alone; but if we were able to prepare apparatus for illustrating striking results, then commenced the inquiry—"how do these things happen?" and then we looked at the reasoning by which such results were arrived at, inasmuch as all arose from a few simple natural phenomena. When we had acquired the true knowledge of weight, we proceeded by pure reasoning to the properties of the lever and the other mechanical powers, but we ought to exhibit the results in every possible variation, and then the scholar would listen with patience to the reasonings whence the deductions were drawn. The apparatus we had to construct, was divided into two classes. Persons who made original investigations into natural or physical phenomena, required apparatus of delicate construction, because these phenomena did not always admit of being reasoned out. With regard to friction, for example, we knew how many philosophers had experimented on the simple laws of friction. Mr. George Rennie had made some of the most admirable of these experiments, and he alluded to this circumstance with the greater pleasure, because we had the honour of being presided over on the present occasion by a distinguished member of the same family; but others had gone on, and they had found that the more accurate their experiments had been, the more true the laws had appeared. If, however, we constructed apparatus to try such experiments, we could only do so at vast expense; but if we wanted to teach the results, we selected the most striking cases that could be produced, and constructed suitable apparatus for the purpose of exhibiting those results to the classes under instruction. There were, however, a certain number of persons connected with the history of the mechanical sciences who had addressed themselves to the construction of apparatus for the purpose of teaching. He might mention the names of Desaguliers and Ferguson, who delivered lectures on this science in the beginning of the last century, and who published drawings illustrating the apparatus which they employed. Desaguliers's lectures on mechanical phenomena were the first to render the subject fashionable. Then came Mr. Adams, a mathematical-instrument maker, who published some beautiful representations of apparatus for illustrating mechanical philosophy, constructed with great and perhaps unnecessary precision.

His (Professor Willis's) purpose was not to show anything new in the way of experiments, which were for the most part of the most hackneyed kind, but simply to explain his mode of constructing apparatus. Those obtained in general from the shop of the mathematical-instrument maker were so expensive and luxurious in their fittings, that it was next to impossible for an ordinary school to purchase a complete set of them. It could not be said to be the fault of the makers themselves, inasmuch as those who performed the experiments were willing to pay the price charged for the apparatus with which they experimented, and which apparatus was frequently required to be delicately constructed for the purposes of such experiments. If, for instance, you wanted to show that a 1lb. weight was balanced by a ½lb. weight by virtue of a larger leverage, you did not want an assay balance; a mere stick of wood was just as good an apparatus, for the purpose of popular illustration. What he wanted to be taught could be done with very ordinary apparatus. It was desirable to construct your apparatus with the utmost simplicity, with wood work, in order to reduce the expense, and it was also desirable that the lecturers should, as far as possible, construct their apparatus for themselves. This was what he wanted to encourage. He should hold it to be one qualification for a schoolmaster that he should be able to use tools. He thought a person could scarcely be fully competent to teach the mechanical sciences in our schools, unless he was able to make the greater part of the apparatus which he required for that purpose. The true art was to distinguish the parts which required delicacy and care from those which might be made of deal. The delicate parts must be paid for, and the rest might be made of wood, iron, wire, or whatever came to hand. When he wished to construct any apparatus, he made a drawing of it first. He gave one piece to a first-rate mathematical instrument maker, to construct, without regard to expense, and he then set his carpenter or his blacksmith, in Cambridge, to make the rough parts, without telling either of them the purpose for which they were intended. The final adjustment of the parts he took upon himself. The finer parts of the apparatus, of course, constituted the larger portion of the expense. Such was the course he recommended.

He would proceed now to the more direct business of the evening, which was to explain his mode of teaching statics by the mechanical powers, as the one most in vogue in this country. The more refined method was to commence with the action of forces, but that was not the best for teaching in country schools. If you wished successfully to teach the mechanical sciences, you must begin with the things that were ordinarily made use of. He had frequently asked for the fire-irons in the lecture-room, by which to illustrate the action of mechanical forces, and in his lecture-room in London he had got a cuckoo-clock, which could be taken to pieces, and other like toys; all these things excited an interest in persons new to the subject. You first opened a man's eyes; he saw that philosophers were not such abstract creatures, after all, if we would only lend ourselves to the objects around us. He taught himself mechanism by taking clocks, locks, and the like, to pieces, in very boyhood, and many another man had done the same. If we thus taught ourselves by means of common things, why should we not teach others by the same means in our lecture-rooms?

One of the first things required for apparatus was a set of weights. The accuracy of ordinary shop weights was sufficient for the purpose; only it must be remembered that shop-weights were adjusted a little higher than the true weight, because, from use on the counter, they in time wore down, and became less than the true weight, therefore you required them to be adjusted to the true weight, and then nothing could be more convenient for the purpose. The best way of suspending the weights was by means of a short transverse wire, with an eye in the middle, in place of the usual hooks. Two sets of cheap weights must be provided, beginning with eight ounces, and extending downwards to a quarter of an ounce. The next principal implement was a pulley post. This was a very simple piece of machinery—the pulley was the main point. In showing experiments on statics, forces were represented by weights at the end of a string, and to make these forces act in various directions upon the apparatus, the string was passed over a pulley. This pulley was provided with a clamp, by which it could be fixed to any part of a wooden post which was screwed to a heavy iron foot. Every piece of apparatus should perform as many functions as possible, taking care that it did not become a Jack-of-all-trades, and do everything badly. The professor here exhibited a cheap pulley, and contrasted it with a handsome brass pulley with a clamp, made with the delicacy fit for an assay-balance, the one costing as many halfpence as the other cost shillings. It consisted of a slip of thin bar iron, bent round to the necessary shape, with a piece of wire driven through a wooden pulley, and he showed that it turned even better than the more costly production.

The professor having described, from specimens before him, the ordinary mode of constructing the clamp of the pulley, proceeded to point out (also from specimens) the improvements he had introduced into this portion of his apparatus, observing that at the close of the lecture he should be happy to give further explanations to such as desired it. He then observed that all lecturing apparatus ought to be made on the largest possible scale; but the obstacle with such a collection was the consequent necessity of a large place to stow it away. It was, therefore, advisable to make each portion of apparatus serve as many purposes as possible. It was needless to mention the many failures he had experienced in endeavouring to make parts of his apparatus of universal application: their name was Legion. A tripod stand, or foot, exhibited, was mentioned as one that had proved eminently useful. Such a foot served as a general foundation for nearly every piece of apparatus that was placed on the table. It was necessary to have two or three of these cast iron stands on which any portion of the apparatus could be readily attached, and in attaching them he employed the common 3-8th square coach bolts, with fly-nuts. The first mechanical power exhibited was the lever. The action of forces upon one point should come before the lever, but that depended upon the method of teaching. Every one would teach statics according to his own text-book. Two pulley posts, at the proper distance from each other, and a string, in the middle of which was tied another string, the whole provided with hooks at the end, would show three powers in equilibrium on a point, and by applying the ordinary parallelogram of Dr. Lardner the proposition might be verified.

The lever exhibited was a long plain bar of wood, with holes drilled in it, and the bar itself carefully balanced; because, in statical experiments, the bodies acted upon were supposed to have no weight; and to represent that hypothesis we could only have recourse to balancing the bodies. The frame of the lever was constructed so as to prevent the lever from twisting, and there were two pins, on which the lever rested while the weights were placed upon it. This apparatus was adapted to show readily the properties of levers of the different orders, the laws of parallel forces, compound levers, and the various other statical propositions, most of which the professor exhibited.

The next mechanical power in order mentioned, was the wheel and axle. For the construction of apparatus of this kind, the professor employed pasteboard. The wheel and axle exhibited was formed of a large disc of pasteboard, and was adapted for a great variety of uses. Pins were provided as stops, to prevent it from revolving too far whilst the weights were being suspended. In the disc holes were bored, enabling weights to be attached, so as to demonstrate the proposition that forces acting obliquely upon a lever, or upon any solid body, were in equilibrium when in the inverse proportion of the perpendicular upon their directions. It also enabled the teacher to demonstrate the problems of stable and unstable equilibrium, oblique and parallel forces, the parallelogram of forces, the principles of the balance, forces applied in different planes perpendicular to the axis, and the general difference between wrapping and link contact in different planes. The professor then gave various illustrations of the mode of using the apparatus, stating, at the same time, that many portions of statics could be readily shown by it.

The professor next exhibited apparatus for demonstrating the principles of the inclined plane. None hitherto made had ever enabled him to perform all the experiments required in the present state of science. The professor described the construction he adopted—namely, an inclined plane—not hinged at the bottom, as usual, but at the top, with a sliding base, enabling it to be formed into an inclined plane of any proportion desired, the three sides being graduated, two being variable, whilst the third was constant, forming the unit of comparison. This, in conjunction with the pulleys and the pulley-posts, the professor showed, would enable a teacher readily to demonstrate all the principles involved in the inclined plane, including the pressure on the plane.

The screw and the wedge were next adverted to, the professor stating that it was idle to attempt to get rid of friction in making apparatus for exhibiting these powers. To do so would be absurd. The action of the wedge depended entirely upon friction. Without friction it would not act at all. He had, therefore, made his apparatus solely with a view to exhibit a solid diagram of the screw, so as to enable a teacher to show his class that the screw was nothing but a circular inclined plane, and also combined with a lever the power of the screw was produced. It consisted of a tin cylinder, divided into two parts by a spiral cut, the upper painted white, the lower black.

Thus the teacher was enabled to show to persons who were not familiar with solid geometry how the screw proceeded from the inclined plane, as well as another peculiar property of the screw, which had a great interest to a certain class of workmen; the peculiarity being, that the surface forming the thread of a screw consisted of an inclined plane of increasing inclination the deeper the thread was cut. This was shown in the apparatus by a circular inclined plane placed within the other. From this it was at once apparent that the inside portion of the screw must be formed of an inclined plane of increased inclination, inasmuch as the same perpendicular height had to be attained in a shorter space.

The whole secret of the construction of the model was that it consisted of tin plate. If made with tolerable care it was a very useful instrument for teaching. The wedge, the professor stated, he had constructed still rougher, because the theory of the wedge depended so much upon friction. It consisted of a fixed arm and a moveable arm, attached by a hinge, each having a roller. The wedge was suspended between them, and was loaded with a given weight; the moveable arm was also attached to a string passing over a pulley, with a weight suspended at the other extremity. The professor next proceeded to pullies, and described various arrangements for facilitating the manipulation. In order to manage the pulleys well at all, the weight of the pulleys should be taken into account. He had, therefore, so adjusted his as to bring the suspended blocks to the nearest number of ounces that would divide by the power of the combination.

The professor then pointed out to the notice of the meeting a simple means of explaining the nature of reactionary forces and their connection with structures. The apparatus for this purpose consisted simply of three legs, meeting together at a point, similar to the three sticks by which gipsies suspend their kettles. By the addition of as many strings, it could be put readily into the different forms of the shears and the derrick employed by engineers, and the different action of the forces in each case readily explained.

The professor next explained a system of pasteboards, which he had found very useful in enabling persons to set off and calculate, by descriptive geometry, the strains, and to demonstrate the directions they take.

By means of three sheets of pasteboard, cut in such a manner as to allow of their intersecting each other, with coloured lines so drawn as to represent the various forces, and the manner of resolving them, a class could readily be made to understand problems involving geometry of three dimensions. By this simple means the action of the three legs, the shears, and the derrick could be readily demonstrated, and the actual forces calculated by geometric measurement. Other applications of this system of pasteboards were shown, such as the distribution of weights supported on a three-legged table, the mode of obtaining the direction of bands connecting two pulleys not in the same plane, &c. Time did not admit of the professor showing other models which were placed on the table.

Professor Willis then proceeded to explain his new arrangement of Attwood's machine, and concluded by saying that the whole of the models would, in a short time, be exhibited in the galleries of the Museum of Economic Geology, in Jermyn-street, for the use of any persons interested in examining or copying them.

The professor hoped that his efforts in this direction would tend to reduce the unnecessary luxury of construction, and consequent high price, of philosophical apparatus, and that gentlemen connected with lecturing might be induced to follow his example in themselves constructing their own apparatus.

The CHAIRMAN proposed that a vote of thanks be given to Professor Willis, for the very able and lucid explanation which he had given upon this most interesting subject. At that late period of the evening he did not know whether any gentleman wished to make any observation. If so, he should be most happy to hear it. But he thought that Professor Willis had put forward this subject in so clear a light that it was almost impossible to add anything. He considered that it was one of the most important subjects that could possibly be brought forward, and it had fallen into the hands of one of the most able men of the present day to deal with it. The subject of simplifying the apparatus by which all mathematical and practical science was taught, and ought to be taught, was so important that he was very glad to find that such a man as Professor Willis had devoted his time and attention to it, and he had conferred a great public benefit by the very clear and simple manner in which he had described it. Everybody must be aware that the expence and difficulty of procuring models to illustrate the first elements of mechanics had been very great, and although the facts that they taught were very simple, yet it required a great deal of study to bring one's mind to bear upon them before we could thoroughly comprehend them. He thought that by what Professor Willis had done he was entitled to the thanks not only of the Society, but of the public and the nation. This apparatus, although apparently very simple, had been a work of very great thought, and as the Professor had very kindly taken an unusual degree of pains to illustrate it, perhaps he would still grant the further favour of allowing these models to remain at the Society for a day or two, so that members might have an opportunity of examining them. He was sure that the more they were investigated the more they would be found worthy of their attention, and that we were greatly indebted to the Professor for his very great kindness in explaining them.

The vote of thanks was then unanimously passed to Professor Willis, who briefly replied, when

The Secretary stated that the paper to be read on the evening of Wednesday next, the 9th of April, was "On the Manufacture of Articles from Steel," by Mr. J. Wilson. On this evening T. Dunn, Esq., will preside.

ECONOMIC MUSEUMS FOR THE WORKING CLASSES.

In the *Sydney Empire* for Tuesday, November 27, 1855, is a letter, signed "Joseph Dyer, Secretary, School of Arts," in which it is stated that the Governor-General had recently caused to be printed and circulated Mr. Twining's original Memorandum, entitled "Special Museums for the Working Classes." After giving a summary of this pamphlet, Mr. Dyer proceeds to consider the manner in which such a museum would be advantageous in that colony. He says:—

"First in order, I will suppose we had a museum illustrating the best construction of houses of all descriptions, with models that would enable a workman to apply the information conveyed. Let us take the present mode of constructing a slab-house in the rural districts of this colony. Is it done in the best manner? The timbers, I believe, are generally placed perpendicularly. Now, in America, where they have at least 100 years more experience than we have in the construction of log huts, the timbers are placed horizontally. A model of log huts from various parts of America would be very important. Again, the timber huts of the Swiss mountaineers might furnish us with most valuable hints. Those wide projecting eaves and exterior staircases are not only picturesque, but convenient. In this climate I can fancy they would be delightful At all events it is but reasonable to suppose that both in Switzerland, in America, and in many other countries by the experience of years and the continual adoption of such improvements in construction as suggest themselves to inventive minds, the art of constructing timber houses is much better understood than with us. Let us obtain models from thence, then, by all means, and abolish those unsightly tenements that deform so greatly the aspect of our country districts, and afford our rural population unhealthy, insecure, and even indecent household accommodation."

Again he says:—

"In the construction also of small town residences. Although in this city I am delighted to observe so many instances of that honourable 'pride to rear an independant shed' which has caused the stone-built suburb of Woolloomooloo to rise so rapidly into existence, I yet think that if the thrifty freeholders of these noble monuments of industry and perseverance had had access to the best designs for such structures, and could refer to models of all the recent improvements that have been made, a great amount of labour might have been saved to them and an infinitely better general effect have been obtained. It is well known that the ingenuity of hundreds of architects at home has been exerted for years past in the design and structure of small tenements. Now I do not think that the result of their labours is obtainable in a tangible form anywhere in this city. Only fancy, sir, what an advantage it would be to a man preparing to build a house, to be able to go into a museum where he might see models of foundations, of wall work, of timber work, of flooring, of hollow bricks, of stoves and grates, of iron pillars and girders, of flues and staircases, &c., of easily constructed doors and shutters and economical fastenings, or where he could see a pattern-card of cottages, all designed on principles combining health, economy, and convenience."

He then proceeds to suggest several other particulars, leaving it to each reader's own ingenuity to apply a measure to the advantage that would be gained by all classes. He thus observes:—

"We want to know how to wash sheep rapidly, safely, and well with very little labour. We employ at present, I believe, the rudest possible method for the purpose. I think it would be very easy to suggest some improvement in this useful colonial art. We do not know, I suppose, how it is done in all other countries. Models would teach us. I should be happy to exhibit a model for the application of machinery to this purpose.

"*The packing of wool in bales.*—I think the cotton bales of America are, as a rule, much better packed than our wool bales. Perhaps they are not, and I am mistaken; but I have no doubt whatever that such an extremely inventive nation as the Americans have machines, of easy application and great power, by which they compress their cotton into a small compass; at all events, it would do us no harm to see what methods they employ for this purpose. Models would teach us.

"*Mining for gold.*—It will not be denied, I suppose, that the Americans have gone a-head of us here in the application of machinery. If a museum had been established in this city at the outset of the gold discovery, with models of cradles, washers, long toms, troughs for conveying water to a distance, and all the various inventions which we have now acquired by a long and painful experience, how much labour, and how many thousands of pounds would have been saved. All these things models might have taught us."

Further on he says:—

"Do we, for instance, understand the storing and refrigerating of water like the Arabs who have made it their study for ages; or the Mexicans? Have we the best method and the handiest apparatus for grinding our wheat and baking our bread in our country districts? Can we learn no lessons in curing and preserving meat from the hunter of the prairie? Are there no methods of finding water in sterile places that inhabitants of a dry country could teach us? Could the South American tell how to break in and train our herds of wild horses? Could not India gives us some valuable hints in the construction of vast reservoirs and tanks against times of drought? Could not Canada tell us how to produce immense quantities of potash from our burning forests? Has the hardy American backwoodsman any means of clearing his interminable forests that our settlers might copy with advantage? Have they no powerful root-extractors that clear their lands of the stumps that deform ours, and render ploughing almost an impossibility? Above all, do we know anything about their system of plank roads, corduroy roads, and cheap railroads, by which they have opened up so many thousand miles of country? Surely these object are most desirable, and many more might be named, but I hope I have done sufficient to attract public attention to the scheme, which, if it is set on foot at all, should be made self supporting, although in the first instance it would be a proper subject for a liberal government grant to set it on foot."

AMENDMENT OF THE PATENT LAWS.

A public meeting was recently held in the Town-hall, Manchester, to petition parliament, and memorialise the patent-law commissioners, to allow the large surplus fund which has accumulated under the Patent-law Amendment Act of 1852, to be appropriated to a further reduction of the stamp duties now paid for obtaining letters patent for inventions. Wm. Fairbairn, Esq., F.R.S., presided.

The Chairman said, the meeting had been convened for the purpose of considering a series of resolutions in relation to the patent laws. Prior to the amendment of those laws in 1852, the cost of obtaining a patent was from £300 to £500 for the three kingdoms; the cost was now £175. The first cost was £5; the second, in six months, £20; the third, in three years, £50; and in seven years, £100. The number of patents taken out under the new act had so greatly increased that there was a surplus over the expenses of the patent office. This surplus had accumulated, in 1854, to £65,000, and in 1855, to from £90,000 to £100,000. What was to be done with this surplus? It was desirable to prevent such a large sum from going into the hands of the Chancellor of the Exchequer, and he (Mr. Fairbairn) thought that something should be done with it whereby a reduction would take place in the cost of obtaining patents; the cost ought not to be more than £80, or what was just necessary to carry on the machinery of the patent laws.

The following resolutions were carried:—

Moved by Mr. M. Curtis, seconded by Mr. Weild:—

"That as improvements in the arts and manufactures, and in mechanical and chemical science, have greatly conduced to extend the commercial greatness and power of the British dominions, every encouragement should be given to inventors consistent with the public welfare."

Moved by Mr. Richard Roberts, and seconded by Mr. Cresswell:—

"That in obtaining protection by royal letters patent, inventors should not be subjected to more expense than is sufficient to defray the entire cost of an efficient office and staff, and that it is unjust to tax them for their ingenuity."

Moved by Mr. Thos. Hopkins, and seconded by Mr. Johnson:—

"That a large surplus fund having accumulated from the stamp duties paid for obtaining letters patent, under the Patent Law Amendment Act of 1852, the government would be encouraging the ingenuity of our countrymen by foregoing the right to appropriate the said surplus fund to the national treasury."

Moved by Mr. W. A. Fairbairn, and seconded by Mr. Forsyth:—

"That it is the opinion of this meeting that the present stamp duties for obtaining letters patent for inventions might be reduced to one-half the amount at each stage or period of payment, and that there would still be a large surplus fund after paying all the expenses of offices, printing, supplying public libraries with copies of specifications, indexes, &c. It is therefore desirable to place the said surplus fund as a reserve at the disposal of the commissioners, for the purpose of complying with the spirit of the act of 1852, and for enabling them to reduce the fees or stamp duties from time to time, in proportion to the accumulation of the said fund."

Moved by Mr. Haley, and seconded by Mr. Sharrocks:—

"That the commissioners should be skilled in mechanical and chemical science, and devote the whole of their time to the Patent Office, and be paid by fixed salaries instead of fees."

Moved by Mr. Henry Fletcher, and seconded by Mr. Bell:—

"That a petition based upon the resolutions now passed be presented to the House of Lords, by Lord Brougham, and to the House of Commons by the Right Hon. T. M. Gibson, and that the Right Hon. T. M. Baines be requested to support its prayer; and that a memorial from this meeting, signed by the chairman, be presented to the Commissioners of Patents, soliciting their support and co-operation to obtain the consent of the government to allow them to carry the views of this meeting into practical operation."

The proceedings closed with a vote of thanks to the chairman.

Home Correspondence.

ON TEACHING MECHANICS IN SCHOOLS.*

Sir,—Having been engaged during the past seven years as a teacher of chemistry and natural philosophy, I have taken the liberty of offering a few remarks on the subject of Professor Willis's paper. On the industrial importance of introducing elementary mechanics as a branch of national education, and the possibility (where the disposition and ability exist) of doing so, my mind has long been made up, and every day's experience only strengthens my conviction of the usefulness and suitability of such subjects for elementary schools. Wherever simple multiplication and division are taught, elementary mechanics may be commenced, and as the boys advance in arithmetic, so may they advance in mechanics. I have always regarded arithmetic as the most important subject in a school; boys who are good at figures are generally good at other things; but arithmetic, to be really valuable, must be taught as a science, not as a mere exercise of memory in rules, but as a discipline of the mind. It is because arithmetic has not been so taught, that the reasoning power of working men is generally very defective. Nearly all useful and practical questions in mechanics may be solved by a boy who understands proportion, but when levers are substituted for hogsheads of sugar and yards of calico, good-natured committees rise up and say, you are giving these boys a much better education than we had, and is it likely that a boy who can solve a question in the steam-engine, will ever think of getting a livelihood by hard work. The class who hold such opinions is still numerous, but every year diminishes their number, and it is only occasionally they have the moral courage to give expresion to such opinions. Elementary science is not much taught, and I fear some time must pass away before we can reasonably hope for much advance.

In the old endowed grammar and middle schools Latin and Greek are still studied, to the exclusion of almost every subject likely to be of practical benefit, and when these poor boys get into the world, they find out that the ordinary education of a national school would, in many instances, have been preferable to what they have received. I do not think I am overstating the matter when I say that there is not one of the old endowed schools of London where the least encouragement is given to the teaching of those common things which all boys ought to know and understand; many of the schools are pretty much the same as they were 160 years ago. The man who sends his boys to such a school in the present day does them an injustice. I am not speaking disparagingly of the study of Latin and Greek, the question is not so much whether these subjects shall be studied, but whether it is not desirable to introduce a knowledge of those things which bear more immediately on the practical business of life. It will probably be said that I take a very utilitarian view of education; I admit it, and when we have to deal with those who have to live by their labour it is the only useful view we can take. To those who have the time, ability, and means, a more rigid and exact course of study is no doubt desirable, and I should be very sorry to see the country deprived of the valuable services of abstract thinkers.

In national and British schools all the ordinary subjects of education are taught, and in many of them well taught. The only drawback is the early age at which the boys leave school. Nothing worthy of the name of elementary science is taught in these schools, except in the case of some of the Birkbeck schools, where it forms a systematic part of instruction. The education of the children of the working classes is gradually passing into younger and less experienced hands. Before the pupil-teacher system came into general operation, two or three good schools existed for the training of schoolmasters. The men who qualified themselves for the profession of a teacher were those who had distinguished themselves by great natural aptitude for teaching, either in a Sunday or evening school; many of them had served an apprenticeship to some mechanical occupation, such as carpenters, printers, smiths, shoemakers, and watchmakers; they were, in all cases, men who belonged to the class they had to educate. As soon as the Minutes of Council came into full operation the cause of education was deprived of the valuable services of any more of this class. Our training schools are now filled with sharp inexperienced boys and young men, clever in the solving of difficult equations, and in most cases able to pass a much more difficult examination than that required for many departments in the civil service. It was not to be expected from men whose early education had been very much neglected, who had spent some years of their life in the factory or the workshop, that in a written examination they stood any chance with the technical requirements of pupil teachers, but in professional skill and a thorough knowledge of the habits and wants of the working classes, they were infinitely superior, and more useful to the state than those we have now. I could point to the schools of these men scattered over the country which are very properly and justly regarded as model schools. At the time these men were trained, workshops were considered an essential element of training schools; models of steam-engines, water-wheels, mechanical apparatus, bridges, pumps, maps representing the physical peculiarities of the country, with looking-glass inlaid to represent the water, were manufactured by the students to illustrate the lessons given by the masters. As soon as they were appointed to a school, generally a month a two before they left the institution, their time was occupied in making apparatus. For years many of these men taught elementary mechanics and the principles of the steam engine with apparatus of their own manufacture. Except at Chester, I believe nothing of the kind is now done at any training school. The pupil teachers have for the most part a dislike to manual labour; they have very little mechanical ingenuity and power of manipulation; such attainments, if possessed, cannot be measured by a written examination, and nearly every thing in a training school is done to this end. If elementary science is to be taught, we must not only provide schoolmasters with suitable apparatus, but we must teach them how to use it, and this is especially true in reference to chemistry. I would not recommend much apparatus, and experiments which are doubtful should rarely be attempted in a school. What seems to me most wanted is apparatus which shall illustrate principles on as large a scale as possible. Things have been constructed for appearance more than use. Mathematical accuracy has been attempted when it was by no means necessary, and the price has often placed it beyond the reach of ordinary individuals. Any complex apparatus, likely to get out of repair, is quite unsuitable for schools. Good illustrations of the lever, the wheel and axle, vertical and horizontal pullies, the inclined plane, models of pumps, steam engines, cranes, and generally those machines in common use in the particular locality in which the school is situated. In schools and classes in Mechanics' Institutes you rarely find persons capable of that reasoning upon which the solution of a problem depends. The style of teaching, and the subjects taught, must be adapted to the minds intended to receive the instruction. Some things which may be a useful acquisition to one mind, may not be so to another. To those who are without any aptitude for mathematical investigations, you must supply by experiment what they cannot do by reasoning; and all the leading principles of mechanical science, can be so illustrated. The mathematical training of Cambridge frequently unfits men for that style of teaching and illustration which adapts itself to the capacity of working men. The trade schools which are springing up in different parts of the country, will, I trust, open up a new field for the more general cultivation of science, especially those sciences upon which the industrial arts depend. The influence of art teaching is now felt in every class of society. What has been done in art, will, I hope, be done for science. No subjects are so well adapted for general instruction as those which admit of experimental illustrations, it arrests the attention of the children, they look forward to the experiments, and if you impress on their mind what you intended by the experiment, it makes a deep and lasting impression.—I am, &c.,

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* The following letter, from Mr. Buckmaster, of the Wandsworth Trade School, was received some days prior to the delivery of Professor Willis's lecture on Wednesday last.—Sec.

J. C. BUCKMASTER.

Wandsworth Trade School, March 28, 1856.

PROFESSOR WILLIS'S LECTURE ON APPARATUS FOR TEACHING MECHANICS.

Sir,—I beg leave to offer a few remarks upon the highly interesting description of apparatus and models brought before the Society of Arts, this evening, by Professor Willis, who deserves the highest praise, from teachers of natural philosophy in particular, for the very great attention he has given to this department of educational aid. Without pretending to the experience and skill of the learned professor in this subject, I yet venture, as an humble individual, who has made some practical acquaintance with philosophical apparatus, to suggest that a somewhat simpler arrangement for showing the properties of the lever might be effected. In the instruction of persons of ordinary abilities, especially the young, by popular lectures, it is highly necessary that little or no complexity of arrangement should be presented *to the eye*. Now, I venture to assert that the adjustment for exhibiting the second and third kinds of levers, as proposed by Professor Willis, is one likely to confuse the tyro by the substitution, in place of the usual pulley, of an arm, or second lever, giving to the apparatus the appearance of a compound arrangement. I have, for some time past, used a lever of cheap and simple construction, turning on an axis, and convertible at pleasure, by the intervention of a pulley, to any of the three descriptions of levers usually spoken of. Again, the exhibition of the pressure on the fulcrum, and the more complete case of the relations of parallel forces, may be exhibited by the simple arrangement of a rectangle of wood or other light substance, placed so as to float on the surface of water in a tray; strings are fastened to proper points in the upper surface of this float, and arranged over pulleys, by means of weights. This experiment used to be successfully shown in the class-room of University College. But the main defect in the apparatus exhibited by Professor Willis appears to me to be the want of a surface of a description suitable for drawing upon, immediately at the back of such experiments as are designed to illustrate the laws in relation to the composition and resolution of forces. For this purpose I find most useful a circular black board, about three or four feet in diameter, standing in a vertical plane; to the centre of this I can attach a smaller circle, moveable about an axis through its middle, which may be acted upon by weights attached, over pulleys, to certain points, so as to illustrate the theory of moments, or the general case of the lever and the wheel and axle; or, removing the smaller circle, I can exhibit varieties of the composition and resolution of forces in the same plane; the black board enabling me, by the aid of scale and compasses, to show geometrically the relation of the weights to the sides of the quadrilateral. With respect to weights, I would suggest that cylinders, formed of brass tubing, of different diameters, and filled with lead, would be found preferable to those exhibited; such a set I possess in my collection, and can answer for their cheapness and greater simplicity of appearance. Perhaps I may also be allowed to say that white cord is best adapted in all cases where the direction of the force is required to be exhibited in the lecture room, particularly for the pulleys. The remaining apparatus cannot, I think, receive any suggestions towards improvement such as I have ventured to offer, being most admirably adapted for the object Professor Willis has in view in its formation. The pulleys, inclined plane, screw, wedge, the clamps, stands, &c., are convincing proofs of the superior advantages obtainable by employing apparatus designed and manufactured by the skilful teacher himself. In the case of one of our London colleges, notwithstanding the possession of a most extensive collection of apparatus for natural philosophy, the manufacture of some of our best instrument makers, it was found needful frequently to have recourse to the carpenter and smith to supply the place of more costly, but perfectly useless arrangements.

I am, Sir, yours, &c.,

FREDERIC JAMES MINASI.

Islington, April 2, 1856.

EDUCATION OF THE ARTISAN, AND EMPLOYMENT OF WOMEN.

Leeds, March 31st, 1856.

Sir,—The members of our Mechanics' Institution and Literary Society were much interested, on Wednesday sen'night, by a lecture from Mr. John Bennett, of London, on "A Watch; what to make, and how to make it." The explanations are so lucid, graphic, and vivaciously given, that the audience could not fail to obtain a pretty correct idea of of the construction of that invaluable pocket mentor

—a good watch. But the portion of the lecture which excited the deepest and liveliest interest was that in which Mr. Bennett described the economy of the manufacture as carried on in the Swiss Cantons, on so large a scale, and at so low a cost, as to threaten the extinction of this department of our productive industry, at any rate so far as all but the very best and most expensive articles are concerned. In confirmation of this view it was stated, that last year Neufchatel alone made a million and half of watches, while Great Britain only produced 180,000. Mr. Bennett ascribed this result to the joint operation of several causes;—first, to the education of the people; second, the minute subdivision of labour; third, to the very extensive employment of women, who exhibit a delicacy of manipulation peculiarly suited to the almost microscopic work connected with the fitting up of a watch.

Now, important as this is, as regards the particular article adduced, to exemplify the utility and profit of a philosophically practical application of means to ends, it forcibly suggests the consideration of the same questions in relation to many branches of our manufactures. The advantage of division of labour is a "great fact" in manufacturing industry so universally acknowledged that I need not advert to it. But, though there is a vague acquiescence in the doctrine, that a well instructed is, upon the whole, better than an ignorant, population, the practical relation of the education of the worker to his work is neither clearly recognised by the operative nor the employer. The *practical mind* of England is impatient of such subtle considerations as these, and as it often discovers that the most dexterous hand is the least book-learned, it inclines to the notion that a good craftsman is illiterate, as a matter of course, and it is now very much perplexed with the dogma, that the well-instructed mechanic—all other conditions being equal, is immeasurably superior to his unlettered shopmate. May I insinuate further, that the idea of "Jack being as good as his master," is not quite naturalised in the practical mind? Now, although there exists abundance of evidence on this subject, I am not aware of its having been collected and put forth in a popular form, or with the distinct and emphatic sanction of men so far representing the manufacturing industry of our country as to be regarded as acknowledged authorities. Mr. Charles Knight's excellent tract, on the results of machinery, since re-issued with several on collateral topics, under the title "Knowledge is Power," embraces many of the arguments on this subject; and in Mr. Fairbairn's recent work, the education of the mechanic is, I am happy to find, strongly insisted on. In Dr. Lyon Playfair's papers on cognate subjects, the utility of scientific instruction to our working population is admirably enforced and exemplified by the real studies of the German and French schools. But no large section of either employers or operatives is likely to see these or similar works; moreover, the active, enterprising, and, upon the whole, intelligent class of masters—of all grades—are not as yet educated men. The prudence which has helped them to escape the casualties of trade, has also taught them to be very shy of any theories or schemes not confirmed by such experience as they possess or can appreciate. Besides, the so-called "scholars," who occasionally attract their notice, and not unfrequently excite their contempt, commonly acquire the title on the strength of some mere facility with the pen and tongue, of questionable utility, and of which "Practical mind" is apt to say, "Let that appear when there is no need of such vanity," especially when unaccompanied by corresponding handicraft aptitude. The clear exposition of the kinds of knowledge which it is desirable the operative classes should possess, the specific benefit to be expected from its diffusion, the loss of time, material, and effectiveness experienced in every shop and factory from the deficiency of such knowledge, these are subjects which I venture to submit should be laid before a large body of the trading and manufacturing classes, and I know of no place so suitable for the purpose as the Hall of the Society of Arts. The paper on the subject should be given by some gentleman well known, not only as an employer of labour, but intimately acquainted with the workers and their work, so that the charge of speculation and theorising, in place of reasoning from facts, would be quite untenable. Every means should be taken to secure a good assembly of the representatives of every description of manual industry; and I am persuaded that the paper and discussion sent broad-cast over the land, would give a smart impulse to the sluggish indifference still existing on this all-important and most practical question.

The other topic suggested by Mr. Bennett's lecture is one which I feel to be of vital national importance—the extended employment of women in many of those manipulations hitherto exclusively performed by men. Of the million and half of watches fabricated last year at Neufchatel, it is a simple fact that a very large share of the work was entrusted to female hands. Mr. Bennett asks, why cannot we employ the active fingers of our young women in the same way? The question is a very natural and rational one, and its answer might, I conceive, take the Hibernian form of reply, and further enquire, why we should be precluded from employing women in any occupation in which they are qualified to excel? I have no statistics at hand to refer to, but I believe I shall not be far wide of the mark in asserting that, except in teaching and producing a few of the ingenious fabrics of the needle, no large body of women is engaged in any handicraft operation calculated to bring into exercise an appreciable amount of skill or intelligence.

I am aware of the efforts which have been made to turn female talent to account in the arts of design, engraving, &c., and I heartily wish them success, but as yet we can only congratulate ourselves on an auspicious beginning in these departments. Education, as regards men, has, to a very limited extent, diverted labour from its usual channels. The tradesman's son is apprenticed to a business as of old, and, except he be a great booby, he works hard, and feels a pride in his labour. Not so with the daughters of middle-class England. It it needless to enumerate the employments they were wont to consider reputable; it is sufficient for our purpose to remark, that the only source of livelihood now deemed respectable by the females of this class of society is that of a governess or teacher, and thousands are, in common parlance, highly educated, to qualify them for this avocation, either directly or as a contingent means of support. The result may be read at large in the advertisements for situations by ladies anxious to teach several languages, with music, and an English education, and who only ask food and shelter, delicately paraphrased "the comforts of a home," as an equivalent for their services. Failing this, they sadly swell the squalid ranks of the distressed needle-women of our great towns; at domestic service or other drudgery they cannot work; to beg they are ashamed. This is no fancy picture; it records a melancholy state of things, of which I have personally known many instances. But the mistaken pride to which the very narrow acceptation of the term "genteel employment" is attributable is yielding to the pressure of necessity, and the good sense of the parties vitally interested in the question; and, I have no doubt, that the offer of occupations in which women of good education, and accustomed to the comforts and proprieties of good society, could engage without loss of self-respect or offensive association, would be eagerly sought by thousands of most intelligent and respectable young women; especially in manufactures requiring the exercise of taste, would the qualifications of well-educated women prove valuable, as the absence of all cultivated refinement among the humbler classes unfits them for such avocations.

The "distressed seamstresses" question, too, is hastening to a solution through the instrumentality of sewing-machines, which execute with the greatest facility the work most trying to the eyes and least remunerative—the finest stitching, and must soon supersede a very large portion of needlework, whether performed by men or women. In every department of our textile fabrics, from spinning the yarns to weaving the most complicated patterns, women are employed, not in toilsome drudgery, but in watching the operations of the machinery, correcting, adjusting, and vigilantly preventing the defects and irregularities which varieties in the integral structure of materials occasion with the most perfect mechanical appliances. And no one doubts for one moment that a woman does all this better, and even more easily, than a man could.

This subject would, I also think, afford an excellent one for consideration by the Society, especially if treated by some gentleman, or, still better, by a lady, who would be at the pains to collect the statistics of female labour in this country, and also in France, Switzerland, Germany, and the United States. The French ladies undertake a host of duties which we never entrust to any but the "lords of the creation," and we may possibly profit by their example without slavishly following it. The United States has demonstrated that factory labour may be associated with—as it indeed offers many facilities for—the exercise of literary tastes and intellectual pursuits; and the "merry Swiss maids," according to Mr. Bennett, have well-instructed minds to direct the fairy fingers they employ so deftly in watchmaking.

This letter has extended beyond the limits I designed, and I will, therefore, only add that I hope the subjects broached in it may shortly be properly discussed by the Society.

Yours truly,
W. H. J. TRAICE.

PATENT LAW REFORM.

7, Duke-street, Adelphi, March 31, 1856.

Sir,—Allow me to "*placer mon petit mot*" in the important debate on Patent Law reform, so ably taken up in Mr. Bridges Adams's letter. Although both the *exposé* and the conclusion drawn show the clearness of apprehension of a practical man and the precision of a mathematician, yet, I cannot help thinking that an important item has been overlooked by that eminent critic. I mean to allude to what I should call "international rights of inventors."

The rights of inventors having often been compared, in full justice, to the common copyright, I do not see why they should not include the same advantages as the latter, which has already been effectually secured by international treaties between most of the civilised countries. In the circular of the Minister of Agriculture, Commerce, and Public Works, alluded to in the late discussion and in Mr. Adams's letter, the French minister complains of the possibility of unprincipled persons pirating French inventions, and patenting them in foreign markets. There certainly exists more than a possibility of such unfair proceedings, for if a patient compiler of all the valuable material on patent matters collected daily at the Great Seal Patent Office from abroad and at home were to compare the many specifications of a similar title which have been filed at about the same time in different countries, he certainly might discover many cases which would give rise to strong suspicions as to the veracity of one party, at least. Now, why should not such a nuisance—such an immorality—be abated at once by the introduction of a legal provision to that effect, in the patent legislation of all such states as would recognise the principle of international rights of inventors? Let England make the first move in that direction. Let her Government say to other Governments,—"We are ready, on conditions of reciprocity, to grant to your inventors the required priority for their inventions in our market, *i.e.*, we shall grant them the power of taking out patents in England as original inventors, from the official date of their foreign patents, provided they do so within a certain time, say three years." Such a measure, should say, would at once cut short all attempts at carrying out piracy from one country to the other, since no lust of gain, however great, on the part of a pirate, could withstand the dread of the original inventor coming forward within three years; whilst, on the other hand, full scope would be given during that time to inventors, as well as to the public, for testing really good inventions, and for bringing them honestly in the market. To resume, I should wish to see the following fifteenth clause added to those put down by Mr. Bridges Adams:—

"All foreign inventors, from such states as have concluded international treaties on reciprocal terms, shall be entitled to letters patent in England, that shall bear the same date as those taken out in their respective countries, provided such applications are made by them or their assignees within three years from the date thereof."

Finally, allow me to call your attention to the subjoined extract from the *Scientific American* of the 15th ult., edited by Messrs. Munn and Co., at New York, and which enjoys a deserved popularity in the United States. That article is of a certain interest, since it shows how the present question of Patent Reform is looked at on the other side of the water.

I remain, Sir, your most obedient servant,
A. TOLHAUSEN,
Sworn Interpreter at the Imperial Court of Paris.

Extract from the "Scientific American" of 15th March, 1856, (*Vol. IX., No. 27*).

"As the British Patent Fund is not exclusively the product of British contributions, we claim to have a voice in the disposal of it, and in the name of our inventors, who pay a considerable amount yearly to it, we ask for a reduction of British patent fees.

"The British patent fees have been greatly reduced from what they were previous to 1852, but they are still too high. They may be still further reduced one-half, and yet pay all the expenses of the Patent Office handsomely. We hope British inventors will begin and advocate this reform, and press it vigorously upon Parliament. The English Patent Laws were made for rich, not for poor inventors; and it is well-known that the great majority belong to the latter class. There is not one English journeyman in ten who is able to pay the large patent fees charged for protection. When an English journeyman mechanic invents a useful machine, he has to seek the patronage of a more wealthy person to enable him to secure his invention. He is, therefore, obliged to place himself in the power of another person, or lose the benefit of his invention. Such a system is too strongly feudal for the present age; and we call upon Sir Joseph Paxton, who was once a journeyman himself, to devote his energies, first, to the removal of this the greatest evil connected with the English patent system. We admire the efforts he has made to secure the surplus Patent Fund from the grasp of the Government—to save it from being used like the general revenue; but we believe the best and justest way of benefiting inventors is to reduce the patent fees.

"When the subject of 'Patents' was brought before the late meeting of the British Association, held in Glasgow, it was refreshing to inventors to hear the sentiments expressed by such distinguished men as Sir David Brewster, Fairbairn, and others, regarding the price charged to inventors in England for patents. The combined opinion of these savans was, that patents ought to be granted to inventors free. They considered that inventions conferred great public benefits upon the country, therefore, the public could well afford to grant patents to inventors without charging them for the privilege. We could also advocate the same policy, as a measure both wise and politic for our country; but as politicians would always be growling at the necessary appropriations for the Patent Office, our inventors, we know, would disdain to have it insinuated that they were the least burden upon the country. For this reason, therefore, we advocate moderate patent fees—the lowest possible to pay the necessary expenses of the Patent Office, and no more. And as Judge Mason has recommended a reduction of our patent fees to British subjects, we hope English inventors will also zealously advocate a reduction of theirs, for their own benefit and that of our inventors who may desire to secure patents in that country."

A LETTER ON YERVA DE PARAGUAY.

Sir,—Mr. W. Bridges Adams says, in his interesting "Chapter on Yerva de Paraguay," that I am wrong in calling the article used as tea in South America by the name of *Maté*, which he says is the Indian for calabash.

I will not pretend to contest the point with him as to the absolute meaning of the word, but I am quite prepared to prove that not only do several personal friends of my own, who are natives, and have been residents of Brazil, assert that the term is always, in that country, applied to the material used, namely, the twigs and leaves of the Paraguay holly (*Ilex Paraguayensis*), or Yerva de Paraguay, literally the Paraguay herb, or plant. Moreover, I have invariably seen it imported into Liverpool under the name of *Maté*; and in every work whose author has mentioned the habit, I find a similar application of the word—at least, I should say, in those works known to me. I have examined the Indian vocabularies, collected by Mr. Wallace, and arranged by Dr. Latham, but cannot find the word *Maté*. I am, however, fully aware of the extraordinary variation in the dialect of the South American Indians. I gave the article that name by which it is known in commerce, and also in our best botanical works, and unless your correspondent can show some more cogent reasons for changing the name, I must continue to adhere to that which is so well known and generally used.—Yours truly,

THOS. C. ARCHER.

Proceedings of Institutions.

Greenwich.—Two lectures, on Birds, were delivered at the Society for the Diffusion of Useful Knowledge, on Tuesday, March 11th, and March 18th, by Robert Thos. Hulme, Esq., F.L.S., M.R.C.S.E., Lecturer on Comparative Anatomy and Zoology at the School of Anatomy and Medicine, adjoining St. George's Hospital. The lecturer commenced by observing that, while man was not able to traverse his railways at a greater speed than 60 or 70 miles an hour, the eagle would accomplish as many as 140, and that the fishing eagle descended with such rapidity upon its prey, that the eye could scarcely follow it. The power of long-continued flight was exhibited by the migratory birds, many of our summer visitors coming from Central Africa. More extraordinary still was the occurrence in this country of the yellow-billed cuckoo and the purple martin, natives of America, and which must have passed over the whole width of the Atlantic Ocean. This power of flight was shown to be intimately associated with the hollow condition of the long bones of the bird. These cavities communicate with the lungs, and are filled with air, the temperature of the bird being double that of the atmosphere. This air becomes rarified, and the animal may be described as a living balloon. The structure of the feathers was explained, and shown to justify Paley's observation, that "every feather is a mechanical wonder," while the eider down had been proved to be the most perfect material for warm clothing of all animal and vegetable productions. The history of the birds of prey was then entered upon. There are birds remarkable for their powers of flight and of acute vision, feeding upon dead or living prey, and guarding man against the diseases that arise from decomposing animal matter. The habits and peculiar structure of the parrots, cuckoos, woodpeckers, and other land birds, were successively sketched out, and the lecturer concluded by observing that, apart from the benefit which the birds bestowed upon the human race in common with many other animals, there was a mental and a moral influence more peculiarly their own. It is the bird which especially gives life and animation to the landscape; their voices are heard heralding the summer, and giving promise of the fruits and grain that man is to gather up against the coming winter. Few persons can have listened to the song of the summer bird without experiencing a soothing, or even an elevated influence; that even when the snows of winter covered the ground the robin came to us, asking us to relieve his wants, reminding us of the wants of others, and teaching us charity and hospitality to our fellow-man. But for these creatures an almost unbroken silence would reign around, and it was not until they were summoned into existence that the melody of sound was added to the other charms of Creation.

Halifax.—On the 26th ult. a large and influential meeting was held at the Haley hill school-rooms to inaugurate the opening of a Working-man's College, for the instruction of adult workmen in the most useful branches of a literary and scientific education. The College is to be managed by a committee of working men. Edward Akroyd, Esq., took the chair, and was supported by Dr. Booth, Chairman of the Council of the Society of Arts, Mr. G. F. Foster, of Bradford, Mr. Hope Shaw, of Leeds, Mr. Gott, of Leeds, Mr. Wheatley, Mr. John Waterhouse, &c., who severally addressed the meeting.

Royston.—Two years ago the committee of the Mechanics' Institute appealed to the public to assist them in raising a fund for the purpose of erecting a lecture-hall, a museum, a library, and rooms for reading and class instruction. The first steps in the enterprise were taken in March, 1854, and now, in March, 1856, the project has been realised, and on Tuesday in last week, a meeting was held in the lecture hall, for the purpose of publicly inaugurating the new building. It consists of two floors—the museum, a spacious apartment, two reading-rooms, the library, and the rooms for class instruction, being upon the ground-floor; while the lecture-hall, which is 60 feet by 30 feet, and 20 feet high, occupies the whole of the upper story. The hall is lighted with a large sun burner, depending from the centre of the roof, and consisting of seven clusters of nine burners each. The cost of the erection of the building was £1,600, of which sum £1,000 has been already raised by donations, leaving a balance due of £600, which has been advanced by the trustees and the committee. The meeting of Tuesday was presided over by the Earl of Hardwicke, who, in his opening address, observed that the objects of Institutes such as that was to make science known to, and understood by, its members; and that it was by such means that the working classes could best advance their social interests. He then went on to say, that "the educated were distinguished from the uneducated classes by the moderation with which they reviewed the conduct and the opinions of others, and by their indisposition to condemn those who differed from them. And one of the effects of the diffusion of education among the poorer classes would be to lead them on all occasions to contend and argue with justice and moderation, and to become loveable and attached members of society. From the study of science they would learn the important and useful lesson—that man forms and creates nothing; but that science teaches him how to collect and combine from the works of the Creator whatever is useful to man." After the chairman had read a letter from Lord Dacre, expressing regret that he was unable to attend, the Rev. L. V. Harcourt said the subject on which it was his duty to offer a few remarks was, "The Institute; its educational importance to the adult, and to the young after quitting the school." He remarked that "it was a fact, which was pretty well established by the reports of the government inspectors, that very few children remained at school after the age of nine or ten years. And this observation led him to refer to a mistake which had been made by Mr. Horace Mann, and repeated by Sir John Pakington, Lord John Russell, and others who had spoken on the subject of education. The statement was that there are five millions of children between the ages of five and fifteen: and as only two millions are inscribed on the school books between those ages, the inference was that there were three millions of children uneducated. Now this was a transparent fallacy. It was admitted that the majority of children left school at nine or ten years of age, and therefore the numbers should be taken, not between the ages of five and fifteen, but between the ages of five and ten. And, as the number of children between those ages was two and a-half millions, and two millions were inscribed on the school books, it would follow that, instead of there being three millions of children uneducated, there was really only half a million uneducated."—The Hon. Eliot Yorke, M.P., next addressed the meeting on the following topic:—"The Museum: valuable in affording lessons from the past, and illustrations of the present condition of the world, and in preserving records for futurity." He remarked that "one of the old Roman poets had beautifully enforced the truth that the mind was much more readily awakened by that which presented itself to the sight, than by that which reached it through the intervention of the ear. When a man saw an object, it aroused his curiosity, and stimulated him to inquire. He therefore urgently appealed to them to give a voice to the now bare walls of their museum—to make them speak to the hundreds and thousands who might hereafter enter this building in a language peculiarly their own."—Mr. Puller then rose to speak to the following subject:—"The reading-room—an inestimable boon to the industrial classes, in providing well-conducted newspapers and wholesome periodical literature for their amusement and instruction." He said that this subject naturally divided itself into two parts—the one having reference to newspapers, and the other to scientific publications. As the advantage to be derived from a study of science had already been urged on the attention of the meeting, he confined his remarks principally to the benefits derivable from the newspaper.—The Rev. T. Robinson, D.D., said the subject which had been consigned to his advocacy was, "The education of all classes as a means of social and moral improvement." "In dealing with this question, it was necessary," he said, "to determine what was education. He would give a definition, which, as far as it went, he believed they would accept as a correct one. Education was, he considered, the development of the mind of man in all its powers, for good ends. Education was not a mere mechanical work, carried on and completed at the Grammar School, or at the University; but it was a constant development of the mind, a drawing forth of the intellectual powers of the man, leading him to think at every step, teaching him that he has feelings, and affections, and desires which link him with the human kind, and unless they are excited, directed, controlled, and trained into channels of usefulness, he himself is an isolated being—no good to himself or to his fellow creatures. Education was to teach and enable a man to live to really good and useful ends, to have loftier aims and nobler objects than the gratification of his own appetite or the exaltation of himself among his fellows, to promote the good of mankind and the glory of God." Dr. Robinson concluded by calling attention to the proposal recently made by the Society of Arts to give certificates of proficiency to young men who may successfully pass examinations in different branches of study.—The Rev. W. W. Harvey then addressed himself to the next topic:—"The Library and its Use," and said that they might divide the contents of a well-formed library into three sections—Professional Works, Works of Imagination, and Works that treat of the History and Philosophy of Facts.—Votes of thanks to the chairman, and to the gentlemen who addressed the meeting having been unanimously passed, the meeting separated.—The committee intend, in the month of May, to open an exhibition of objects illustrative of science and art and their application to manufactures, natural history, archæology, &c. The committee have received many offers of aid, and they hope that the receipts on that occasion, as well as special donations to the same end, may enable them, ere long, to completely liquidate the debt of £600 still remaining on the building.

Southampton.—On Monday night a large number of the members and friends of the Polytechnic Institution, assembled at the Royal Victoria Assembly-rooms, for the purpose of considering the benefits and advantages derivable from Mechanics' Institutes.—Mr. J. R. Stebbing, the president of the Institution, took the chair, and called upon the secretary, Mr. Pond, to give the meeting an outline of the position and prospects of the Institution. It appeared that it had been 27 years in existence, during which time it had encountered many difficulties, notwithstanding which the Institution had been the means of greatly assisting the cause of education in Southampton. At present it was in debt; the many calls which had been made upon their funds, owing to the increase of members, had to some extent been the means of bringing about these difficulties. The present number of members is 380, and the expenses, it seems, are more than the proceeds can comfortably bear.—Dr. Booth was then introduced to the meeting by the chairman. He said: The stock subjects of discussion at meetings like the present have been so often handled, that one hardly knows what to say that has not been said, and said much better, a hundred times before. Who at the present day doubts the necessity of education, or the utility of instruction, or the dignity of knowledge, or the advancement of learning, or the progress of civilisation? Now, as I am not master of so much originality of thought as to be able to place such trite topics and threadbare subjects under a newer dress and more becoming attire, I had much better seek for freshness in the ground I occupy rather than in the mode of treating it. I will, therefore, without further preface, place before you what the Society of Arts in London is proposing to do for the advancement of education. Many of you are no doubt aware that nearly all the Mechanics' Institutions and Literary Societies of the country are in union with the Society of Arts. Now we propose to hold periodical examinations, conducted by men most of them of the very highest eminence in science, literature, and commercial knowledge. At these examinations it is intended to give prizes, appointments, when placed in our hands (as two have been annually by that constant and liberal friend of education, Mr. John Wood, Chairman of the Board of Excise), and certificates of merit to be awarded with the most scrupulous rigour and the strictest justice. We trust that these certificates so awarded will be accepted by the public as testimonials of competency and proficiency. To ascertain how far the public might be disposed to acknowledge the utility of such a scheme, and to place confidence in the Society as well, the Council drew up a form of declaration of confidence, and had it circulated to some extent throughout the country. Now, this declaration of approval of the plan proposed to be followed, and of confidence in its development under the control of the Society of Arts, has received a very large amount of public support. Very few public documents have ever exhibited a larger amount of influential independent public opinion than the one I hold in my hand. Fortified by the clearly expressed approbation of the manufacturing and commercial interests of the country, we shall proceed to develop our scheme of examination. But the Institutions must support the Society of Arts in working out this measure. They must aid us by holding preliminary local examinations, as the Leeds and Huddersfield Institutions, the Liverpool Collegiate Institution, and other important establishments are preparing to do, so that our examiners shall not be subjected to the trouble of examining, and the irksomeness of rejecting, candidates wholly unprepared to pass any examination. If the Mechanics' and other similar Institutions of the country are willing to support us, we shall be prepared to co-operate with them to the utmost of our power. It is only within the last few days that the privilege has been conceded by the Committee of the Privy Council of Education to the Society of Arts of supplying to the Institutions in union with it books, maps, and other educational apparatus at the reduction in price—a very great one indeed, some 50 per cent.—which is now allowed to national and other schools under inspection. This is a great boon to the adult population of the country. I only hope they may be induced to avail themselves of this most valuable privilege to the widest extent. But now some of you may ask what is the use of examination? An examination only tests the amount of knowledge a man has: it does not furnish him with it. It sounds the depth of water in the well, but it does not contribute the supply. Now, even granting this, it may be a matter of much importance to learn the exact depth and quality of the water in the well, whether it be clear and deep, or turbid and shallow. But at the present day men are pretty well agreed as to the value of examination. Success in competitive examination is now the sole passport to employment in the East India Company's service. It is also a necessary preliminary to admission into the Royal Artillery and the Royal Engineers; into the Admiralty, the War Department, into the Privy Council-office, and the government departments generally. Examination is now everywhere admitted to be a most valuable test of fitness, and a most efficient stimulus to education. But when, nine years ago, I reasoned out all those results which are now universally accepted as truths, and put them together in this pamphlet which I hold in my hand, "Examination the Province of the State," my views were looked upon as visionary and Utopian. You will find here all the arguments, or nearly all those which are now so triumphantly used to show how examination is not only the best test of proficiency, but the most effectual stimulus to acquire that proficiency. I cannot but think that a general system of national examination, to be gone through by every person before admission to employment, would do more to promote education—I mean voluntary education, or self-instruction—than any mere increase of our schoolhouses or schoolmasters, or any amount of local rating. Few men, indeed, at the present day, remain ignorant through sheer inability to obtain the necessary books or the requisite instruction. They wallow in the mire of ignorance, indolence, or sensual indulgence, because they have no tangible inducement to exert themselves to rise out of it. Make education a thing actually equivalent to pounds, shillings, and pence—an article of money value—and then she need no longer cry aloud in the streets—the multitude will seek and obtain her, however difficult to find. Why should not the youth intended for commercial or manufacturing pursuits have the same or equivalent inducements held out to him to labour as the son of the nobleman who proceeds to college? That it is not so much the want of education as the want of inducement that is felt, may, I think, be clearly shown from the reports of her Majesty's Inspectors of Schools, who, with singular unanimity, complain of the early abstraction of boys from school. The parents are induced to take them away by the hope of the most trifling pecuniary advantage. Supply one something greater on the other side, throw a small preponderating weight into the other scale—the hope of worldly advancement—and we shall no longer have to complain that the education of our middle and lower classes is nipped in the bud by domestic necessities or parental selfishness.—The Hon. and Rev. S. G. Osborne congratulated Dr. Booth upon having lived to see what he had so much desired—a plan in operation for throwing open to unaided merit situations not only under the government, but in many other positions equally honourable and lucrative, requiring sound education and high principles. He congratulated them that such was the case, as there was now an opening for every young man, who chose to put forth the talents with which God had blessed him, to carve out a path through life for himself. He had lived a great portion of his life amongst mechanics, and he had thereby learned to have an interest in them, and to know the difficulties which beset their path, and to know that there was no class of men to which he would sooner open fields of intellectual knowledge than those who moved the hand by the training of the head.—Sir A. Cockburn, M.P., then rose and said, the chairman had adverted to the difficulties under which Institutions of the kind laboured, owing to the state of the law in reference to their rating and taxation. All he could say was, that he would give his most anxious attention to the subject, and would do all he could to effect such modifications of the law as would remove the difficulties under which Institutions of the kind laboured.—The Hon. Judge Norton next addressed the meeting, testifying to the advantages of education, and the facilities given by Institutions of the kind which they were met to support, for extending and promulgating its existence.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst., 2, General Monthly Meeting.
London Inst., 7, Dr. Edwin Lankester, "On the Recent Progress of Vegetable Physiology."
Chemical, 8. 1. Professor Way, "On New Methods of Determining Minute Quantities of Nitric Acid and Ammonia;" 2. Messrs. Abel and Bloxam, "Contributions to the Chemical History of Nitric Acid."
Entomological, 8.

Tues. Royal Inst., 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½. 1. Mr. Bonomi, "On the Temples of Egypt;" 2. Dr. Bell, "On Lepsius' Chronology of the Apis;" 3. Mr. Purland, "On Comparative Hieroglyphic Interpretation."
Civil Engineers, 8, Mr. C. R. Drysdale, "On Steep Gradients of Railways, and the Locomotives Employed."
Medical and Chirurgical, 8½.
Zoological, 9.

Wed. London Inst., 3, Prof. Rymer Jones, "On Entomology and the General Organisation and Metamorphoses of Insects."
Literary Fund, 3.
Society of Arts, 8, Mr. James Wilson, "On the Manufacture of Articles from Steel."
Geological, 8. 1. Mr. S. H. Beckles, "On the Strata in the Cliffs at Hastings;" 2. "Mr. J. S. Wilson, "On the Geology of Sydney, Australia;" 3. Dr. Wright, "On the Stratigraphical Relations of the so-called Sands of the Inferior Oolite;" 4. M. A. Boué, "On the Probable Origin of the Dover Straits by Means of a Fissure;" 5. Dr. Croker, "On the Rocks and Lignites of Bovey Tracey, Devonshire."
Graphic, 8.
Royal Society, Literature, 8½.

Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.

Fri. Astronomical, 8.
Philological, 8.
Royal Inst., 8½, Mr. C. W. Siemens, "On a New Steam Engine."

Sat. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, "Dr. A. W. Hofman, "On the Non-Metallic Elements; their Manufacture and Application."
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 14, 15, 17, 18, 20, 22, 27, 28, 29, *and* 31 *March*, 1856.

Par. No.
74. Duchy of Lancaster—Account.
87. Fees on Baronetcies, &c.—Return.
90 (1). Civil Services Estimates—Class 1.
92. Masters (Navy)—Nominal Return.
98. Committee of Selection—3rd Report.
96. Clerks of the Parliaments—Copies of Patents.
97. Schools in Rural Districts—Return.
90 (1). Civil Services Estimates—Plans referred to in Class 1.
90 (3). Civil Services Estimates—Class 3.
95. Procurators Fiscal, &c. (Scotland)—Return.
23. Prisoners for Debt, &c.—Abstract of Return.
94. Wool and Woollen Manufactures—Returns.
105. Army (Crimea)—Nominal Return.
41. Local Acts (17, Lowestoft and Beccles Railway; 18, Bournemouth Improvement and Pier; 19, Aberdeen, Peterhead, and Fraserburgh Railway; 19 (a), Poole and Bourne Valley Railway—Sittingbourne and Sheerness Railway—Thames Embankment and Railway—Admiralty Reports.
78. Court of Chancery (Ireland)—Return.
100. Isle of Man (Ecclesiastical and Civil Offices, &c.—Returns.

101. Supernumeraries (Ireland)—Return.
102. East India (Oude)—Return.
82. East India (Annexation of Berar)—Correspondence.
99. Metropolitan Improvements—Statements.
103. Convicts (Orders of License, &c.)—Return.
104. East India—Territorial Accounts.
88. National School (Belfast)—Correspondence.
106. Formation, &c., of Parishes Bill—Minutes of Evidence, &c.
71. Bills—Police (Counties and Boroughs) (amended.)
70. Bills—Reformatory Schools (Scotland) (amended.)
69. Bills—Commissioners of Supply (Scotland) (amended.)
72. Bills—Formation, &c., of Parishes (as amended by the Select Committee.)
74. Bills—Wills and Administrations.
Commissary General Filder—Copy of a Letter.
Church Estates Commissioners—5th General Report.
Statute Law Commmission—2nd Report.
Turnpike Trusts—1st Report by the Secretary of State.
Paris Universal Exhibition—Reports, Part 1.
Prisons—16th Report of Inspectors (Home District), Part 1.
Post Office—2nd Report of the Postmaster General.
Colonial Possessions—Reports.
Prisons (Scotland)—17th Report of the General Board of Directors.
Swiss Confederation—Treaty of Friendship, Commerce, &c.
Committee of Council on Education—Financial and other Tables.

Session 1854-55.

516. Pilotage—Return.

Delivered on 1st April, 1856.

39 (2). Trade and Navigation Accounts (29 February, 1856.)
90 (4). Civil Services Estimates—Class 4.
63. Bills—Advowsons.
68. Bills—Aggravated Assaults.
73. Bills—Cambridge University.

Delivered on 2nd April, 1856.

61. Bill—Bankruptcy and Insolvency (Ireland).
Public General Acts—Cap. 7, 8, 9, and 10.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette March* 21*st*, 1856.]

Dated 4th March, 1856.

553. George Lodge, sen., John Ogden, and George Lodge, jun., Leeds—Improved apparatus for effecting the consumption of smoke in steam boiler and other furnaces.

Dated 5th March, 1856.

555. Richard Dugdale Kay, Accrington—Improvements in the manufacture of fabrics from fibrous materials.
557. Samuel Last, Oxford-street—Improvements in trunks or portmanteaus, and an improved lock for the same.
559. William Green, York-street, City-road—Improvements in ornamenting and waterproofing fabrics.

Dated 6th March, 1856.

560. Thomas Beatt Sharp and Thomas Forsyth, Atlas Works, Manchester—Improvements in coupling railway rolling stock.
562. Henry Davis Pochin, Salford—Improvements in the manufacture of aluminous and siliceous compounds.
563. Richard Philp, Suffolk-parade, Cheltenham—Improvements in paddle-wheels for propelling vessels in water.
565. Robert Morrison, Newcastle-upon-Tyne—Improvements in pile-driving machinery.
566. Benjamin Browne, Stockwell—Improvements in the construction of spindles for locks and latches, and in the mode of connecting the same thereto, and to their respective knobs.
567. Auguste Neuburger, 39, Rue de l'Echiquier, Paris—Extraction of oil from a vegetable substance not hitherto so used.
568. John William Scott, Worcester—An apparatus for fastening or securing buttons, which may itself be used as a stud or button.
569. Richard Archibald Brooman, 166, Fleet-street—Improved method of creating a vacuum, together with certain arrangements of apparatus for preserving substances liable to injury or corruption from prolonged exposure to the atmosphere. (A communication.)

Dated 7th March, 1856.

570. John Downie, Glasgow—Improvements in moulding or shaping metals, and other materials.
571. Chevalier Guillaume Hahner, Leghorn—Improvements in the treatment of ores. (A communication.)
572. David Brown and William Brown, Smethwick—Improvements in rolling railway switches from railway bars, and in rolling taper ends or other bars requiring the same.
573. Frederick Hale Holmes, London—Improvements in machines known under the name of magneto-electric machines.

Dated 8th March, 1856.

574. Thomas Cook, Lieut., R.N., Addiscombe—Improvements in portable bedsteads.
575. Henry B. Young, Barnstaple—Improvements in steam engines.
576. Henry Cooke, Manchester—Improved machinery or apparatus for dyeing and dressing yarns or threads.
577. Jean Jules Robert, 18, Portugal-street, Lincoln's-inn-fields—A process which extracts the greasy particles contained in the waters after the cleansing of wools, by the means of sulphate of zinc and arsenicous acid.
578. David Yoolow Stewart, Glasgow—Improvements in moulding or shaping metals.

Dated 10th March, 1856.

580. Leon Chablin and Antoine Hennique, 39, Rue de l'Echiquier, Paris—A new mode of ornamenting ceramic and vitreous products.
582. Pierre Hippolyte Gustave Bérard, Paris—Improvements in manufacturing artificial flowers and foliage.
584. James Mills, Oldham—Improvement in spindles used in certain machines for preparing, spinning, and doubling cotton and other fibrous substances.
586. Joseph Davy, Manningham, near Bradford, and John Milnes, Clayton West, near Huddersfield—Improvements in looms for weaving plaids, plain weaving, and flounces, or other ground-work.

Dated 11th March, 1856.

590. Oliver Maggs, Bourton Foundry, Dorset—Improvements in the straw shaking apparatus of thrashing machines.
592. John Fowler, jun., Havering, near Romford—Improvement in the manufacture of bricks and tiles.

INVENTION WITH COMPLETE SPECIFICATION FILED.

614. William McCarton, 21, Clarence-place, Dublin—Improvements in the drying of corn or grain for grinding and preserving and apparatus for performing same, and is applicable to drying of other seeds.—13th March, 1856.

[*From Gazette March* 28*th*, 1856.]

Dated 6th March, 1856.

561. Luke Duncan Jackson, 3, Alfred-place, Alfred-road, and Henry Myers, 51, Alfred-road, Paddington—The combining air and water as a power.

Dated 10th March, 1856.

579. Robert Hannah, Glasgow—Improvements in pottery kilns.
581. Pierre Denis Nolet, Rue de la Lune, Paris—Improvements in pen-holders.
583. Robert Smith Bartleet, Redditch—Improvements in cases or holders for machine and other sewing needles.
585. Francis Joseph Emery, Cobridge—Improved means of arresting the descent of cages or corves in the shafts of mines which may also be applied to stopping the fall of weights.

Dated 11th March, 1856.

587. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements applicable to bakers' ovens. (A communication.)
589. Henri Greene, Windlesham, near Bagshot—Improvements in locomotive engines and carriages running on railways. (A communication.)
591. Henry Petitpierre, 15, Avenue de St. Ouen, Batignolles, near Paris—Improvements in sawing or cutting stone.

Dated 12th March, 1856.

593. Henry Horner and Richard Bagley, Sheffield—Improvements in buffers and draw and bearing springs for railway and other purposes.
594. George Spencer, 6, Cannon-street—Improvements in supporting the rails of railways.
595. John Martin Stanley, George Bellamy, and William Booth, Sheffield—Improvements in the manufacture of rolls for rolling steel, copper, lead, or other malleable material.
596. Christopher Richard Norris Palmer, Strand—A new telegraph and improved telegraph or signal apparatus, parts of the invention, apparatus, or manufacture being applicable to other purposes.
597. John Vigars, Marytavy, near Tavistock—Improvements in machinery for lifting in mines, also applicable to other purposes.
598. Edmund Alfred Pontifex, Shoe lane—Improvements in the manufacture of tartaric and citric acids, and tartrate of potash and soda.
599. Liphar Mathurin Chalange, Nogent-sur-Seine, France—Improvements in corn-mills.
600. William Corbitt and George Shaw, Masbro' Works, Rotherham—Improvements in buffer bearing and draw springs for railway and other carriages.
601. Frederic Howorth Edwards, Newcastle-upon-Tyne—Improvements in railway brakes.
602. William Bramwell Hayes, Manchester—Improvements in looms for weaving.
603. John Northcote Ryder, Thames-street—Improvement in the slide valves of steam engines.
604. George Murray, Whitehill Point, Northumberland—Improvement in the construction and manufacture of wheels for locomotive engines, waggons and other carriages to be used on railways.
605. Thomas W. Taylor, Cannelton, Perry, U.S.—Improvement in flying or roving frames.

Dated 13th March, 1856.

607. Pierre Hippolyte Gustave Bérard, Paris—Improvements in the manufacture of waterproof fabrics, which improvements may also be applied for rendering other substances waterproof.
608. Joseph Sturge, Kennington, and Alfred Sturge, Northfleet—Improvements in rotary fluid meters.

609. George Rees, Clerkenwell—Improved method of producing figured or ornamental surfaces on glass.

610. Isaac Dixon, Liverpool—Improved propeller for steam ships and other vessels.

611. Grand de Chateauneuf, 39, Rue de l'Echiquier, Paris—A hydropneumometric gas meter.

612. Thomas Porter, Manchester—Improvements in looms for weaving carpets, coach-lace, velvets, and other piled fabrics. (A communication.)

613. James Murdoch, 7, Staple-inn—Improved mode of manufacturing cut velvets and other similar fabrics. (A communication.)

Dated 14*th March*, 1856.

615. Prosper Pimont, Rouen—A certain process for restoring metallic spoiled pens.

616. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvement in capstans. (A communication.)

617. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvement in ships' windlasses. (A communication.)

618. Philip Marcus, Well-street—An apparatus for working the damper in steam-engine furnaces. (A communication.)

619. William Yates, Bromley, Middlesex—Improvement in furnaces.

620. William Clay, Liverpool—Improvements in the manufacture of the points or switches and crossings of railways.

621. William Edward Newton, 66, Chancery-lane—Improved machinery for separating gold and other metals from their ores. (A communication.)

Dated 15*th March*, 1856.

622. Charles Coates, Sunnyside, near Rawtenstall—Improvements in apparatus for communicating motion to machinery used in bleaching, printing, dying, and finishing fabrics.

623. Louis Joseph Richard, Tirlemont, Belgium—Improvements in sugar manufacture.

624. Joseph Benjamin Hawkins, Reading—Improvements in couches or sofas, parts of which are applicable to other like furniture.

625. Edwin Thomas Wright, Wolverhampton—Improvements in the manufacture of steam-engine boilers, iron ships and boats, and such other vessels and things as are or may be made by rivetting together metal plates.

626. Robert Walter Winfield, Birmingham, and John Simms, Fleet-street, and Thomas Lloyd, King's Norton—Improvements in the construction and ornamentation of metallic bedsteads and other articles of metallic furniture.

627. James Rice, Foley-place, and William Rice, Lieutenant H.E.I.C.S.—Improvements in breech-loading repeating gun and rifles.

628. Joseph Dumas, Marseilles—Improved description of tile. (A communication.)

629. William Oldham, Southam, Warwick—Improvements in the manufacture of cement.

630. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

631. Charles Randolph and John Elder, Glasgow—Improvements in marine engines.

632. Joseph Pegg, Monk Wearmouth—Improved steering apparatus.

Dated March 17*th*, 1856.

633. John Mitchell, Dunnings-alley, Bishopsgate-street Without—Improvements in apparatus for washing and amalgamating ores and other matters.

635. Charles Benjamin Normand, Havre—Improvements in the treatment and employment of steam in steam engines, and in apparatus for effecting the condensation of steam.

637. Thomas Palmer, Tavistock—Pumps, with a new or improved box and valve.

639. William Graham, Glasgow—Improvements in marine compasses, and in adjusting the same on board ship.

Dated 18*th March* 1856.

641. Peter de Prades, Camden New-town—Improvements in wheelbarrows.

643. Edward Rowley, West Bromwich, and John Hadley, Birmingham—Improved method of shaping iron.

645. John Drury, Paddock, near Huddersfield—Improvements in steam boilers for preventing explosion thereof.

647. Harby Barber, Belgrave, near Leicester—Improvements in the manufacture of hosiery goods.

649. Peter Appleton, 7, London-street, New Swindon—Improvements in knives for peeling apples, potatoes, and other fruits and roots.

INVENTION WITH COMPLETE SPECIFICATION FILED.

690. Lazare Ochs, St. Josse-ten Noode, Belgium—Improvements in the manufacture of certain kinds of paper from the refuse of tanned leather. (A communication.)—19th March, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed March 20*th*, 1856.

2131. Henry James Harcourt.
2134. John Musto and Frederick Bear.
2138. William Wright and John Wright.
2144. Gustavus Huguenin.
2148. James Nasmyth.
2153. Anaxagor Epaminondas Guilbert and Charles Louis Guillemère.
2162. John Talbot Pitman.
2336. Samuel Statham.
2342. William Tatham.
2456. James Smith Cottrill.
2554. William Webb and John Webb, junr., and James Catstree.
2874. Henry Robert Abraham.
2924. David McCallum.
2928. Alfred Krupp.
42. William Oliver Johnston.
50. Conrad Abben Hanson and John Wormald.
64. Samuel Middleton.
120. John Fowler, junr.
122. Henry R. Worthington.
182. Archibald Turner.
232. John Whitehead.

Sealed March 25*th*, 1856.

2161. William David Gray.
2170. Henry Bernoulli Barlow.
2173. David Chadwick, Herbert Frost, George Hanson, and John Chadwick.
2181. Auguste Edouard Loradoux Bellford.
2192. Alexander Sands.
2214. John Lancaster.
2234. Adolph Coutinho.
2255. Julien François Belleville.
2289. Hugh Greaves.
2296. George Tomlinson Bousfield.
2298. George Tomlinson Bousfield.
2363. Vincent Scully and Bennett Johns Heywood.
2372. William Shears.
2386. Alfred Ardouin.
2395. Edwin Pugh.
2403. Peter Cranke Wood.
2429. Thomas James Swinburne.
2446. Edwin Thomas Truman.
2509. William Lund and Alexander Bain.
2825. Alfred Krupp.
2853. William Hemsley.
2861. Christopher Nickels and James Hobson.
2957. James Cochran Stevenson and John Williamson.
27. John Fowler, junr.
56. Alfred Vincent Newton.
214. Jean Louis Ambroise Huillard.

Sealed April 1*st*, 1856.

1376. James Lowe.
2186. Joseph François Victor Augier.
2187. George Baker and Charles Miller.
2191. John Riddel Musgrave, Robert Musgrave, and James Musgrave.
2194. Laurent Marie René Péan.
2195. George Rennie.
2198. Julian Bernard.
2209. Robert Wilkinson.
2216. Thomas Henry Ryland.
2223. François Modeste Demait.
2224. Peter Alexander Halkett.
2233. William John Roffe.
2258. Stephan Goldner.
2290. Germain Adolphe Tibierge.
2313. William Edward Newton.
2341. John Smith.
2343. William Armand Gilbee.
2351. Pierre Arnaud Massip.
2353. Nathaniel Shattswell Dodge.
2392. Thomas Beatt Sharp and Richard Furnival.
2422. Jules Jean Baptiste Sylvain Martin de Lignac.
2430. Thomas Shipp Grimwade.
2473. Robert Spring Garden.
2497. Charles Hanson.
2504. Louis Benoit Advielle.
2571. Alfred Vincent Newton.
2595. Robert Walter Swinburne.
2617. Edward Orange Wildman Whitehouse.
2683. Charles Jean Baptiste Barbier.
37. Joseph Wright.
67. Frederick Albert Gatty.
92. Harry Emanuel.
101. Nathaniel Shattswell Dodge.
141. Nathaniel Shattswell Dodge.
194. David Fisher.
261. Alfred Vincent Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

March 18*th*.

685. Samuel Radcliffe and Knight William Whitehead.
710. William Mann Crossland.
927. Isaac Simpson.

March 19th.

698. Samuel McCormick.
739. Samuel Fox.
775. George Fergusson Wilson and James Freeman Lee.
776. George Fergusson Wilson.
779. William Crofts.
783. George Fergusson Wilson.
784. George Fergusson Wilson.
785. George Fergusson Wilson.

March 20*th*.

689. Thomas Sykes.
712. Charles William Siemens and Joseph Adamson.
792. Frederick Wm. Mowbray.
915. Jean Baptiste Maniquet.

March 22*nd*.

721. William McNaught.

March 24*th*.

859. William Penn Cresson.
890. James Noble.
894. James Noble.
974. Cyprien Marie Tessie du Motay.
985. George Fergusson Wilson, William Henry Hatcher, and John Jackson.

March 25*th*.

732. James Worrall, jun.

March 26*th*.

737. Thomas James Perry.
773. George Hanson and David Chadwick.

March 27*th*.

740. George Edward Dering.
741. George Edward Dering.
744. Luke Smith and Matthew Smith.
768. Christopher Nickels.

March 28*th*.

757. Julian Bernard.

March 29*th*.

750. Laurence Frederick Keogh.
797. William Beckett Johnson.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3822	March 28.	Glass Instrument for Measuring the Density of Fluids	Negretti and Zambra	Hatton Garden.
3823	March 28.	Portable Heater or Boiler	Charles Ford	Hanley.

Journal of the Society of Arts.

FRIDAY, APRIL 11, 1856.

SEVENTEENTH ORDINARY MEETING,

WEDNESDAY, APRIL, 9, 1856.

The Seventeenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 9th inst., T. Dunn, Esq., Local Commissioner (Sheffield) for the International Exhibitions of 1851 and 1855, in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Dunn, Thomas.
Jones, Thomas Stead.
Healey, Edward Charles.
Radford, William, M.D.

The paper read was—

ON THE MANUFACTURE OF ARTICLES FROM STEEL, PARTICULARLY CUTLERY.

By James Wilson.

The causes that have fixed the seats of our principal manufactures would form an interesting subject of inquiry. In many instances the particular minerals or earths of a district may determine its manufactures. But this is not invariably the case, for modern systems of transport have more equally balanced the facilities of all localities. Where, however, a trade has been established for centuries, its origin may be generally traced to some peculiarity of the district. Thus we find the manufacture of iron first takes place in those situations where iron-stone and fuel for smelting are in convenient proximity. This, I have no doubt, was the case in the neighbourhood of Sheffield. There are places within a few miles of that town where the Romans have left evidences of their industry and their arts. To the iron, coal, clay, stone, and water power of Sheffield and its neighbourhood, we may clearly trace the origin of its metallic productions. But it is not the object of the present paper to enter into the history of those manufactures, however interesting such a subject might be. The extent to which they are carried at the present time indicates, in a marked degree, the progress of civilisation and refinement. The value of our exports in cutlery and hardware shows that they form a considerable portion of our national industry. As, however, it is asserted that the manufacture of articles from steel is on the decline in this country, and that, as a nation, we are already behind several continental nations, it becomes us calmly to see how far these statements are capable of proof, and to estimate what our capabilities really are. I have no hesitation in saying that the best class of cutlery is of a superior character altogether to the productions of any previous time; and for these reasons. We have material as good as ever to work upon; we have workmen as skilful as the artizans of any preceding age; we have better designs to work from, and the chemistry of metals is better understood, though still, perhaps, not sufficiently appreciated.

In order to render the subject clear, it may be desirable to explain that by the term cutlery, I mean any article manufactured from iron or steel, or both, for cutting purposes. I am aware that such a definition would exclude many articles which, as well as knives and razors, require good material and nicety of workmanship. It will conduce to simplicity to exclude from our minds everything but the essential property of the article. Thus, in speaking of a knife, I simply mean the blade, when not otherwise expressed. Thus a blade, if merely fastened to a piece of wood, is as much a knife as if connected with a handle of pearl. If we consider the properties of a good blade, they will be found to be, hardness, or temper, elasticity, and capability of "holding an edge" equal to the performance of the proper work for which it is designed. Many people, however, have curious ideas of the capability of a blade, and would use a penknife as they would a bill-hook, or expect in a razor the property of an oyster-knife. We must here suppose that each article is used for its proper purpose.

I am not aware how far the proper angle of edges may have been investigated, but I think the cutting angle of a good razor or penknife will be from fifteen to twenty-five degrees. In scissors, however, there is a great difference, as the cutting power is a combination of perpendicular and lateral pressure. The cutting angle is that which will give the greatest strength compatible with sharpness. This will be an angle of about 80 degrees, which affords sufficient strength to prevent "snipping," and sufficient sharpness to answer the purpose for which it is intended. Should the edge exceed a right angle, it would lose sharpness according to the increase in the angle. For "edge tools," or joiners' tools, no fixed rule can be given. From the variety of instruments, and their equally varied uses, it is impossible to adhere to any given rule.

I shall now proceed to show how articles of cutlery are manufactured, so as to possess those properties which should characterise them. It has been affirmed that we possess as good material as ever for the making of cutlery, namely, steel, and I am assured by experienced steel refiners that, when required and paid for, steel can be made of the greatest excellence, though much of a bad quality is manufactured for the production of cheap goods. The steel, as prepared for cutlery purposes, is tilted or rolled to different sizes suited to the articles intended to be produced. This will be best understood by inspecting the specimens on the table. To ensure the necessary degree of hardness, the steel should be compact and dense. It is not considered desirable to use new steel. The reason is not very evident, but it is known from experience that steel works "more kindly" after being kept some time. It is only the makers of first-class cutlery who attend to this, because, to keep a large quantity of steel in stock seems like so much idle capital, though it is necessary in order to obtain the best results. Instead of keeping it in this manner, it is common to use inferior steel, which is easier to work, thus economising labour and favouring cheapness of production. Another reason for the employment of softer steel is, that it is less liable to waste from cracks or fracture, as will be afterwards explained. The forging of articles from steel is much the same in all cases, except that smaller articles are forged single-handed, and the larger ones by double-handed forgers. Thus pen-blades, small scissors, &c., are forged by one man; table blades, razors, edge-tools, &c., by two men—a maker and a striker. The maker attends more especially to the form, while the striker, using a heavier hammer, "draws out" the blade from the rod of steel. It requires several "heats" to complete the forging of a blade, as may be seen from the specimens. Small articles of cutlery are mostly made entirely of steel, but the shanks and bows of scissors of large size, and the bolsters and tangs of table cutlery, are of iron. This is done for the double purpose of economising steel and facilitating the labours of those who work after the forgers. The two metals are welded together in a very simple manner. The burning point of steel is much lower than that of iron, and the quality of the steel would be destroyed by heating to incandescence. But iron may be heated to near the melting point without injury. When both are heated to the required degree, they are slightly dipped in a flux, consisting of borax or siliceous sand, and then hammered together. The junction is nearly always visible upon the reverse of table knives, the iron, not being capable of so high a finish as the steel, appears of a lighter colour. There is one advantage in this appearance. It is a sure indication that the articles have been forged, and not cast. It gives, however. no proof of the quality of the steel. When the forging is completed, the maker's name is struck upon the blade, as well as any other distinguishing mark that may be desired. The blades are then hardened by heating to a red heat, and immersing in water. If the steel be good, it becomes excessively hard and brittle, but its temper and elasticity are given by again submitting it to a moderate degree of heat, which a skilful workman can regulate by watching the changing colour of the steel. This will show the reasons for making the bolsters of table cutlery, &c., of iron. The latter metal is not hardened by the above process, so that the bolsters of table-knives, and bows and shanks of scissors, can be filed and burnished, or "dressed," by any other process, while the blades are so hard as to resist the operation of a file. The process of hardening is so important that it will not, perhaps, be deemed tedious if I offer a few remarks upon it, especially as it will show the importance of a good feeling between employer and employed. I have already stated that soft steel is less liable to waste from cracks or fracture. The process of hardening is so delicate, that a slight difference of heat in excess, either in the fire or water, destroys the quality of the steel, or cracks the blades. Cold is equally, if not more, destructive, and blades are said to be "burnt," "scalded," or "water-cracked," as the case may be. In forging, too, if the steel be heated too much, its close texture is destroyed, and it has more the appearance of the coarse crystallization of iron, as may be seen in the specimens. Where men are not adequately paid for their labour, there is every temptation to produce quantity without regard to quality, and as steel is softer and easier to work at a high temperature, a man has little care whether he spoils his material or not. Discovery is not certain, and least certain as the steel approaches the nature of iron. The burning point of steel is much lower than that of iron, so that where men have no respect for their employers, it is easy for them to do injury with impunity; but where men are adequately paid for their labour, they generally have regard to the reputation of their productions, and work conscientiously for their employers. It will be seen from this how important it is that a good understanding and kindly feeling should exist between employers and employed. If the conditions here stated be complied with, there is no doubt of the quality of the articles, so far as the process of manufacture is concerned.

The next process is "grinding." The stones of some parts of South Yorkshire are particularly adapted for this purpose. They are formed at the quarries, of a round shape, like a cheese, and of various sizes. Stones for grinding table knives are about 4 ft. diameter, and 10 in. in thickness. To prepare them for running, a hole is made through the centre, in which is inserted the axle. Formerly the stones were fixed upon their axles by means of wooden wedges. But as wood is apt to swell with water, the wedges not unfrequently caused the stones to split, and fatal results were common. Now they are generally held at the sides by a pair of strong iron plates, like quoits, screwed tightly to the stones, which, even thus fastened, not unfrequently break. On the whole however they are far more secure, and the accidents resulting from breakages are less serious in their character. When it is stated that these stones make from 100 to 200 revolutions per minute, it will be understood that the heat generated by friction between the stones and the blade, under a pressure of several pounds, will be very great. Indeed, it is such that a piece of iron or steel would become red hot in a few seconds. This of course would destroy the temper of the blade, and render it unfit for use. To obviate this, the stones revolve in a trough of water, thus keeping the blade cool while grinding it to the required sharpness. The stones are used until they are reduced to little more than half their original diameter. The next process as regards table knives is to glaze the blades. This is done on a large tool called a "glazier." It is from 3 to 4 feet diameter, and about 2 inches broad. It is formed in sections of dried wood to prevent cracking, and on this surface, or covered with leather, "dressed" with emery prepared with beeswax, the blades are glazed several times, until of the required fineness. Spring knives are ground upon stones from 30 inches to 9 inches in diameter, and varying from 2½ to 5 inches in thickness. The blades are first roughly ground, to reduce them from pieces or lumps of steel to cutting instruments, and to enable the "cutler," or "setter in," to fit them to the hafts. A description of this latter operation forms no part of this paper. It often happens, however, that the edges of the blades are injured before the knife is completed, so that the edges have to be restored, and the requisite polish given to the blades. This is called finishing, but is the work of the grinders. In finishing the blades it is necessary that they should be re-ground, to take "snips" from the edges, and to reduce the blade to a proper degree of thinness. Another reason for this process is to give correct proportion and nice accuracy of form and outline to different patterns, and to ensure evenness along the cutting part of the blade. This process was formerly done upon dry stones, and was considered highly detrimental to the health of the workmen, and many attempts have been made to remedy the evil, or to prevent it. The most successful plan yet introduced is a revolving fan, which is connected with a pipe extending from the front of the stone to the exterior of the building. The action of the fan effects a partial exhaustion of the air in the pipe, and the atmosphere rushing to supply the partial vacuum, carries with it the particles of grit and steel evolved from the surface of the stone. But for the strength of this current these particles would be inhaled by the workmen, and produce that distressing complaint known as the "grinders' asthma." The most effective means of preventing this disease is not to use the dry stone. This is rarely done in the spring knife trade, as it is proved by experience that the work formerly done on the drystone can be done as well on a wet one, with this advantage, viz., that in the use of dry stones, blades were frequently softened by friction, whereas by the use of a wet stone such occurrences are rare though not impossible. The dry stone is not yet, however, indispensable, as will be seen hereafter.

When a blade is reduced to a proper strength and elasticity on the edge, which should be done on a small stone, to insure the concavity of its sides, the next process is to give it smoothness and more complete regularity than can be effected on a stone; this is done on a tool technically called a "lap." It is a wheel, formed, as before stated, in sections of wood, covered with a surface of lead; this, also, is dressed with emery and beeswax, and greater fineness is given to the steel by the use of vitreous or siliceous stones. For all the purposes of utility, the blade is now sufficiently complete; but where a high finish is desired, it is polished by friction with *crocus*, or oxide of iron, upon a wheel covered with leather. This operation is mostly performed by boys, who begin to lear their trade by finishing the articles upon which they are employed. The blade now only requires to be "set," or whetted, and it is ready for use. Some of the more common kinds of cutlery are done on a wooden glazer. The appearance of this work is rather coarse, but good useful blades may be got up in this manner.

The operations in grinding scissors bear so close a resemblance to the above, that to describe them would be a needless repetition. There are, however, some points of difference in razor-grinding that it may be worth while to mention. In manufacturing the better class of razors, it is usual to "shape" them before they are hardened; and this operation is performed upon a dry stone. The reason for this is, that a stone revolving in water is much softer than when dry; and as the process of "shaping" is much like scraping the stone away, it will be evident that the use of the dry stone is more economical; and as razors are done on very small stones, there would be considerable loss of time in preparing new ones if they were worn down with needless rapidity. The steel also being soft, the operation is more rapidly performed, and no injury done to the blade by frictional heat. When hardened, the blades are ground upon small stones. The concavity of the sides of some razors may be judged from the fact of the stones being worn down to three inches diameter. Some razors are made still more concave by being ground on a stone with a round surface; but this is a more difficult and costly process, without being attended with corresponding advantages. Good razors may be done on tools six or seven inches diameter. This will give the necessary elasticity on the edge, and increased concavity cannot lessen the cutting angle of the edge, on account of the thickness of the back. The finishing process is much the same as in pen-knives. The weight of a razor appears to have considerable influence in the operation of shaving. The heaviest razors, *cæteris paribus*, shave with the greatest ease. Of course, it will be understood that they are not to be so large as to be unwieldy.

I trust the foregoing remarks are sufficiently explicit to convey an idea of the ordinary process of manufacturing articles from steel. There is an almost infinite variety of things so manufactured. But I have adduced cutlery as very fairly representing the processes adopted in all steel manufactures, and as being the most likely to be comprehended by all parties who may feel interested in the subject.

Respecting the character of the workmanship of the present day, I have no doubt that in general excellence great progress has been made. Specimens of skill in bygone times may easily be adduced, and placed in contrast with modern workmanship. But a fair comparison would place the best of a past age with the best of the present, and I think it would not be difficult to show that satisfactory progress has been made. The meeting may form their own judgment from the articles before them. Taste is not a subject of rule and dictum. But I think it will be conceded that the productions before us show some evidences of taste considerably in advance of those of the last generation. Still I must acknowledge that there is ample room for the cultivation of taste amongst our artizans; but I am not aware of any adequate efforts being made to accomplish this object. I fear there is but little disposition on the part of the men themselves to bestow the requisite care and attention upon it. Probably the establishment of museums of local manufactures, and corresponding productions of foreign countries, might awaken an interest amongst our artizans, and induce them to devote the time and attention to this subject which is too often spent in frivolity, or, perhaps, in vice.

Having endeavoured to convey an idea of what is essential to excellence, I proceed to the second part of my subject—and it is not without reluctance that I do so, as it is painful to all right minds to contemplate dishonesty and imposture reduced to a system. The moral sense of mankind seems to have become subordinate to their pecuniary interests, at least, in many instances. Attempts are made to gain rapidly by dishonest means that wealth which it requires a life of honest perseverance to obtain. The method commonly adopted is to produce imitations of articles of known excellence, and of every day utility. All branches of manufacture are liable to imitation with more or less chance of the imposture being detected. But there is great difficulty in detecting spurious articles of steel manufacture, as it is only by attention that a practical cutler would make a discovery of imposition, while the non-practical man would have to purchase his knowledge by experience. Nor would he be certain that the detection of one fraudulent imposition would secure him against another, though it might against a repetition of the same. How far any remedy might be applied to these cases, would, I think, form a good subject for the consideration of the Society of Arts, Manufactures and Commerce. But to this subject I shall revert towards the close of this paper.

There is nothing immoral in the attempt to manufacture at a cheap rate. But as cheapness is obtained generally by inferior material and workmanship, it is dishonest to sell such goods for those of superior quality. Considering these two sources of cheap productions, I propose to show the kind of material and workmanship generally employed, and, contrasting these with those mentioned in the former part of this paper, there will be no difficulty in understanding the difference between good and bad cutlery. "Good" and "bad" are terms preferable to "cheap" and "dear," because a bad article is dear at any price, and utility and excellence are the only cheapness.

The first effort after cheapness of production is inferiority of material. I place this first, as it is the least troublesome method. An interference with labour is a source of unpleasantness. The specimens on the table, showing the process of forging of the best cutlery, will give an idea of the labour bestowed on such articles. The frequent beating with hammers gives great denseness and cohesion to them. Inferior steel would not endure such working, nor produce the like results. The commonest goods are produced "at a heat," viz., they are "cast" or "run." I may state here, to prevent misconception, that "cast steel," which bears the palm for cutlery, must not be confounded with articles "cast" from steel. The former is highly refined and cast into ingots, then tilted and rolled as before stated. But the steel from which articles are "cast" is very inferior, in fact but one remove from iron. This is melted, and blades "cast" from it in moulds by dozens, just as any small ornaments or metal work are cast in numbers. It is called "run steel;" but its inferiority is at once evident when tested by elasticity, or by fracture. This method has the additional advantage (?) of saving the cost of forging. Some of the articles thus made are as follows:—

Scissors.—Perhaps the system of making things of "run steel" commenced with scissors, and it would have been well if the manufacture had been kept to its original intention. I understand that a cheap instrument was wanted for the use of peasants in the wine countries to cut off the bunches of grapes. The acid of the fruit spoilt scissors of the best steel as soon as the commonest. So the idea occurred of making an exceedingly common article for this purpose, and the run steel offered the required means of doing this. And as the smallest possible amount of grinding that would give an edge was sufficient for the purpose intended, scissors were produced at prices fabulously low. This we may admit was a legitimate use of the cheapening process. But, alas! for honesty, the idea grew. The temptation to produce such goods in imitation of better, for household and business purposes, was too great, and a trade in rubbish has sprung up to an awful extent. I am informed, on undoubted authority, that scissors may now be purchased in any quantity at from two shillings and sixpence to three shillings *per gross*.

It is not to be supposed, however, that even run steel is used for these productions. No! the material is baser still—mere pig iron. That there may be no doubt on this subject, any gentleman present is at liberty to break the specimens and judge for himself. Run steel is used for those articles that are to be made in imitation of first-class goods. When first "run," or "cast," they are exceedingly brittle, and require annealing before they are "made up." There is necessarily great similarity in the casting of every variety of common cutlery. Table blades and forks are cast in large quantities, but the remarks already made on scissors render further particulars needless. I am not aware that any razor blades are made in this way. Some years ago the attempt was made, but the Razor Grinders Union passed a resolution that they would not grind such rubbish. I am glad of the opportunity of recording such an instance of honourable conduct on the part of a body of workmen, as I sincerely wish that the moral sense indicated in that resolution could work its way amongst the manufacturers. Though this resolution prevented the introduction of one kind of spurious goods, it is not to be supposed that worthless razors ceased to be manufactured. I have been assured that large numbers of razors are made of such worthless material, that no attempt is made to harden them, as the process would be quite useless. The steel, if such it be, is of so bad a nature, that it would not harden, consequently, the razor, when ground, could not keep its edge.

Pen blades are too small to be made in this manner. They are produced rapidly by means of a fly. The steel is rolled into sheets of the thickness required. These are cut into breadths equal to the length of the blade intended to be made. The steel is inserted in a "bed" of a certain shape, and a stroke of the fly sends a corresponding punch through the steel, carrying with it a piece of rolled steel which is to act as a blade. It will easily be understood that a blade produced in this way is very inferior to one forged from a string of superior steel. It would not have the compactness and density which characterise the best class of cutlery. Blades made by the fly press sometimes go through the process of hardening. But the class of goods manufactured thus is almost invariably of a cheap and useless kind. They are made to sell, and that is the only object of their manufacture. I scarcely need inform my hearers that the *grinding* of articles of cutlery is a most essential process. However good the material, however skilful the forger, a blade lacks its essential property if it is not well ground. Now the defect of cheap cutlery is most apparent in this particular. In grinding, no regard is paid to the *edge* of the article. Indeed, it is not paid for. If the surface of the blade be brightened, it is all that is required. It has the appearance of a knife, may be sold as one, although it does not possess the property which should constitute its recommendation and its utility. In proof of this, I need only refer to the specimens before us.

I must, in candour, acknowledge that I have here presented something like the extremes of cutlery manufacture. It must be understood that there are all degrees of excellence, from one extreme to the other. Some are deficient in material, some in workmanship, and some in both. I do not see any reasonable objection to the production of any of these articles, provided they are sold for what they really are. But they are highly pernicious when offered for what they are not. It is then that they become a cheat upon the purchasers, and injure the character of an important branch of our national industry. The more closely these goods are made to resemble those of our most noted manufacturers, the greater the cheat. There is a large trade in foreign-made spurious cutlery, and I am assured by mark-makers in Sheffield, that they execute large orders for the Continent for marks imitating those of respectable Sheffield manufacturers. On inquiring whether they consider it honest to execute such orders, I was informed, that, "if they did not make them, somebody else would." Such is the simple fact, and the morality of the transaction is rarely called in question. It is a piece of piracy of the worst description. I am not aware of any remedy that a manufacturer has who is thus defrauded of his name and trade. Nor do I see how a remedy is to be applied in this case, unless by a system analogous to that of international copyright. But it appears to me that measures might, and ought to, be taken to check or punish those who are guilty of this kind of forgery at home. And this is a subject which I humbly suggest to the Council of this Society for consideration. It is a question more particularly for the manufacturers, but I do not know of any organisation amongst them to procure a remedy for such an evil. The Society of Arts would be an admirable agent for the accomplishment of this object.*

Though legislative interference in matters of trade is generally to be deprecated, I think it would not be difficult to "make out a case" on the "marking question." This is a subject on which a strong feeling is sometimes manifested in Sheffield; and it is only reasonable to suppose that manufacturers in other localities, and other branches of trade, are equally subject to be defrauded by similar means. In my opinion, it is erroneous to lay down such general propositions, as that "all legislative interference is injurious to trade," &c. It may be pernicious for our rulers to interfere, and dictate as to the mode of conducting a business; but it would not be out of the province of government to restrain and punish fraudulent transactions. A very simple law might be passed rendering it compulsory on every manufacturer to strike some distinctive or distinguishing mark on all his goods. That would be all that is required to give every honest manufacturer all the protection he needs, and it would be ample restraint upon the dishonest, who trade by systematic imposition. Every printer or publisher is required legally to print his name or an equivalent upon his issues. Why should not every manufacturer be compelled to do the same thing in effect? To strike his name merely would be insufficient, as names are common property. But a distinctive mark ought to be compulsory to protect the honest and to punish the dishonest trader. There is a common fallacy respecting striking *names*. It seems to be held that a man's *name* is *his mark*. It would be if no two men had the same name. But so long as names are common, common names cannot form distinctive marks. Allow me to give an instance to illustrate the fraud and enforce the argument at the same time. John Smith, by long attention to the details of manufacture, has established a remunerative trade, and, as he hopes, an abiding reputation. He uses the best materials, employs the most skilful workmen, and strives to stand in the front rank amongst his competitors in trade. Finding that the goods of John Smith have a call in the market, some factor who desires to have a large profit, will not purchase goods of *the* John Smith; but he seeks some man of straw of the same name, and employs him, (or even borrows his name,) to make cheap articles of the same patterns as those that have a call in the market. He is then prepared to sell the goods of John Smith cheaper than the manufacturer himself, as the purchaser supposes. The real John finds his trade falling off. Constant complaints reach him that his goods have deteriorated, and that his customers must really buy of some other manufacturer, unless he returns to his former excellence. He hears that spurious goods are in the market. Some are returned which he finds are not of his manufacture. And tracing them he discovers the delinquent. And what then? He has no remedy. If he applies for an injunction, he is told that spurious John Smith has as great a right to strike his name, as real Smith has to strike his, and that he is trying to create for himself a monopoly, and to crush a poor man. What are the effects of such a state of the law? The *bona fide* manufacturer is injured in his trade and reputation, dishonesty and imposture are justified, and the public are swindled. I am aware it is commonly held that the public are quite competent to look after their own interests, and that any protection for them is needless and impertinent. But the numerous cases that have occurred to my own knowledge, where parties have been imposed upon, even in Sheffield, convince me that the public generally are not competent to detect spurious manufactures, any more than they are generally able to analyze their food and detect the common practice of adulteration. The case I have supposed (which is however, a real case *mutato nomine*), the law justifies on the ground of abstract right; and it is another instance of strict adherence to abstract right, inflicting a positive wrong. No doubt one Smith has as good a right as the other Smith, to place his own name on his own productions. But doing so with a view to dispose of his productions, as those of another man, ought to be a legal offence, as much as it is a moral one. If the Smith of imposture wished to preserve his mark as a distinction in trade, let him have a *distinguishing mark*. If he wished to raise for himself a trade, it would be to his advantage that his goods should be unmistakeable. But when he insists upon using a mark which he knows belongs to another, and has a market value, it is evident that he has a dishonest intention. Against that intention I think it is the duty of the legislature to provide protection, both on behalf of the public and in justice to the honest manufacturer. For these reasons, then, I would render it compulsory upon every manufacturer to use a distinguishing mark, other than his name. I think it would prove the surest check upon the production of spurious goods, and, at the same time, offer every inducement to the manufacturer to make the best articles. I am aware that it is actionable in a court of law to pirate a mark, but it is evaded by the intervention of men of straw, against whom it is certain loss to proceed, for they exist in such abundance, and having nothing to lose, they almost bid defiance to the law. Let it be made felonious to forge a mark, as it is to forge a signature, and there will be but little inducement to rob a manufacturer of his honest name. I should have but little confidence in any remedy that did not go to this extent; and I trust the manufacturers of this country will take up the question with the earnestness that the case demands.

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* Since this paper was written, there have been several intimations in the subjects discussed by the Society, of the importance, I might say the necessity, of some steps being taken to insure the public from imposition of spurious manufactures, and to give to honest manufacturers the benefit of their probity, skill, and enterprise. Writing from memory, I think Mr. Whytock mentioned the subject in his paper on the carpet manufacture, and it has arisen incidentally since. I judge, therefore, that there exists a grievance, more or less, in all seats of manufacture on this subject. Can anything be done in the matter?—J. W

To prevent any misunderstanding, I may be permitted to remark, that I am in no way opposed to *cheap* manufactures, except they are spurious as well as low-priced. I have before stated that no article is cheap that will not answer the purpose for which it is professedly made. That may be taken as a fair test of cheapness. However low in price an article may be, if it will not do what is reasonably required of such articles, it is essentially dear. But in many articles manufactured from steel, cheapness is not incompatible with excellence. For instance, here is a pen-knife which, for utility, is equal to any that can be made. It is plain in workmanship, and has nothing costly in the handle. The price is under a shilling, and, as a knife, it would be no better if it cost ten, the addition being made by more costly material and workmanship expended on the handle. There is a common argument, used in favour of low-priced articles, which I think extremely fallacious under the circumstances; it is, that manufacturers have to meet the wants of all customers, and must manufacture accordingly. "The man who has only a shilling to spare for an article—suppose a knife—can only have one worth the money for it," &c. This would be all very well were he to *get* a shilling's worth for a shilling; but, more frequently, he has sold to him a showy thing that, for utility—the test of cheapness—is not worth a penny. I have already shown that cheapness is not incompatible with utility, and the humblest individual may obtain articles suitable to his wants, and according to his means; and more especially would this be the case were every manufacturer compelled to strike upon his productions a distinguishing mark. This is the great desideratum of our national manufactures if we are to maintain our supremacy amongst the nations; and I most earnestly desire the Council of this Society to give the subject a candid consideration, as I know of no means whereby they could more effectually encourage and promote Arts, Commerce, and Manufactures in this country; and especially do I think such a course would be advantageous to those branches of industry which have formed the subject of this imperfect paper.

Before concluding, I must ask the indulgence of the meeting while I state a few desiderata for the cutlery trades of Sheffield. I am aware that the *Journal* of this Society is read in nearly all parts of the globe; and as there exists great deficiency of ordinary materials for forming the hafts and handles of cutlery, it is possible that the mention of this fact may open new sources of supply. The better qualities of ivory and stag are scarce and dear. Indeed, *horny* substances are much required. Wood of various kinds has been used, but it is not generally so satisfactory as horn of any kind. The woods most commonly used are cocoa, ebony, rose, partridge, and snake, for spring knives; and for the larger articles, as butchers and bread knives, beech and other English woods. However, timber of any kind yet introduced is not in high repute for spring knives; and, in the absence of horns or shells, no composition handles have met with general acceptance. I think there is room for investigation and experiment in this department of our industry, and I shall be glad if this incidental mention of the subject should lead to a successful issue.

DISCUSSION.

The **Secretary** stated that he had received communications from Mr. Moulson and Mr. Sanderson, both of Sheffield, which, with the permission of the meeting, he would proceed to read.

Mr. **Thos. Moulson** (ex-Master Cutler, Sheffield) says, that while there is much in Mr. Wilson's paper which he admires, there are a few points which he thinks might be improved upon. Having acted as the only juror * from England upon steel and its products (Class XV. Group 5) at the Paris Exhibition of 1855, Mr. Moulson at the time addressed a letter to Mr. Wilson Overend, the President of the Committee of the Sheffield Exhibitors, in which he remarked that, "It has been my opinion for some time that the French were superior to us in point of designs for ornamental work. This I found to be the case in their better class of cutlery. In this respect they are superior to even what I had expected; and not only so, but the workmanship, or what may be called "putting together," is, I consider, superior to our best class of manufactured goods. If they are deficient at all, I think it is in their grinding, and their table-blades I consider too thick. The Prussians are improving very fast, both in tools and cutlery, and, I am informed, export to a considerable extent. Many of their goods exhibited are a near approach to Sheffield. I come to the conclusion, then (which is not a new one with me), that Sheffield cutlery, instead of improving, as the cutlery trade has done in other countries, has been on the decline. There are exceptions. While foreigners have been progressing, we have been either stationary or going backwards. I do not wonder, when I take into consideration the system on which the Sheffield trades have been conducted for the last thirty or forty years. Certain causes produce certain effects, and until these causes are removed we shall continue in the same degenerating state, and find it out when it is too late to apply a remedy." He observes that if the Sheffield cutlery trade be in a declining state, it might be worth while to inquire why this was not ascertained sooner, and whether the present agitation in the matter is due to the Paris Exhibition, or to what other cause. It might also, he thinks, be useful to know what proportion the better class manufactures of cutlery bear to the moderate and spurious makes. It would likewise be desirable, in his opinion, to ascertain with some degree of certainty whether, during the last forty years, the cutlery trade of Sheffield has increased in proportion to the increase in population;—whether there is the same proportion of good workmen now as formerly—and, if not, is the falling off due to the large quantity of cheap rubbish that has been produced;—why our trade with the United States in axes, long saws, and augers has nearly vanished, although America used to be our best market; and lastly, of what material the steel is made from which the different kinds of goods are produced. It will be found, Mr. Moulson believes, that the best steel for pen blades, razors, &c., would range from 60s. to 80s. per cwt., whilst that for commoner purposes, made of old nails, old horse-shoes, &c., or in short anything that would melt in the crucible, would not cost more than from 20s. to 30s. per cwt.

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* Although Mr. Moulson was the only juror in this class, it should be stated that Mr. J. J. Mechi was appointed and acted as supplementary juror.—Sec. S. of A.

Mr. **Charles Sanderson** says:—

"I have read Mr. Wilson's paper upon the important staple manufacture of this town with much interest, and I trust that this is only the beginning of a series of papers tending to develop that gradual perfection which is being attained by our talented artisans.

"Although much has been said regarding the decline of our manufactures, and that we are even behind some of our continental neighbours, I have yet to learn that experience, either in the manufacture of steel, or of steel articles, can be acquired in a few years. True it is that our first-rate cutlers' exhibitions are inspected by our continental *friends*, who favour them with small orders for their best and newest patterns—which very shortly appear in our large export markets at a cheap rate, comparatively, but very seldom so good, even in appearance, as our Sheffield productions. Manual labour is cheaper on the continent than with us; but their steel is not so good; it is not so well manufactured, nor are the articles put together with that skill and neatness which so universally distinguish our own. Yet we must not sleep in fancied security; Westphalia has made rapid strides, and France also is improving. A comparison of cutlery made in these countries, some twelve to fifteen years ago, shows the great advance which has been made. By continual improvement, *we* therefore must endeavour to maintain our position.

"Mr. Wilson very justly condemns the use of inferior steel, since the value of the steel required for any knife, &c., forms a very small portion of its cost. The use of soft steel is very large, because, being easily worked, the articles are more readily made; but no workman can give such steel its proper degree of hardness, or reduce it to its required temper or elasticity. But Mr. Wilson will, doubtless, explain to you why cast-steel for penknives and razors is required harder than that used for pocket-knives, and why also steel for scissors is softer still. This seems to me important, because it will show that steel of any defined degree of hardness is not applicable to the manufacture of *every article;* it will show that the steel must, at all times, be manufactured of such a quality and degree of hardness as to fit it for the *especial* production of the article required. The theory of hardening steel will doubtless be an interesting topic for discussion, and some difference of opinion may arise, whether the operation produces a contraction or expansion of the metal; or whether this singular property is due to a different or changed molecular arrangement. This question will, of course, be considered in connection with the process of tempering.

"As regards metal called 'run steel,' the article manufactured from it forms a distinct trade from 'steel' articles, which are always fashioned by the hand. Manufacturers at once discover that these cast-steel articles are not steel, and purchasers find but little difficulty in doing so; some articles are finished very highly, and scissors, perhaps, approach the nearest in appearance to cast-steel. These articles are '*cast*' from charcoal pig-iron, sometimes from a commoner kind, and therefore can scarcely come under the category of 'steel articles.' These cast-iron goods are made in large quantities, and, in distant countries, are sold as steel; whereas the material is only cast-iron. These articles, when cast, are subjected to an annealing process, and are covered with oxide of iron; they thus lose a portion of their carbon, and at a low heat become partially malleable.

"Permit me to call some attention to this metal; it is capable, I think, of material improvement; if the articles made from it are intrinsically better in proportion to the *purity* of the metal from which they are made, some amelioration in the preparation of such metal would be of practical use.

"Mr. Wilson calls your attention to an important matter connected with the manufacture of cutlery. Ivory and stag's-horn are both very dear; wood of various kinds has been used for knife handles; it would be very interesting to consider whether some *new substance* cannot be introduced, the production either of nature or art."

Mr. J. J. **Mechi** begged to correct the statement contained in the communication from Mr. Moulson just read, that he was the only English juror appointed for the examination of articles of steel manufacture at the Paris Exhibition. That gentleman was mistaken on that point, inasmuch as he (Mr. Mechi) had the honour of being appointed a juror, and owing to some accidental cause he was the only juror for that department during the first fortnight after the opening of the Exhibition.

The **Chairman** believed Mr. Moulson meant to convey that he was the only juror appointed for Sheffield.

Mr. **Mechi** said, as he had had the honour to investigate the products of steel at the Paris Exhibition, he might perhaps be permitted to take a more general view of the great importance of that manufacture than had been mentioned in the paper before them, for which he was sure they all felt very much indebted to Mr. Wilson. He might remark that it was a question which largely affected their nutrition, clothing, punctuality, correspondence, locomotion, navigation, and their personal and national safety. It was quite clear, as regarded their punctuality, the question of making good watch-springs was of great importance. With regard to correspondence, there were the ship-loads of steel pins. It was true they were not made in Sheffield, but the steel from which they were manufactured came from that place. Again, with respect to clothing, needles were made from steel-wire drawn in Sheffield. The drawing of the wire was an operation of great importance, and they must have the purest steel to make the best needles. Messrs. Cocker, of Sheffield, were noted in the French Exhibition, as not only being superior in the manufacture of steel-wire, but also as the makers of superior wire-drawing machines, which were of equal importance in reference to that branch of steel manufactures. With regard to nutrition, leaving out of the question reaping-hooks, scythes, and other things of that kind, within the last year or two steel had been extensively employed in the manufacture of digging-forks. In 1851 a committee of the Royal Agricultural Society was formed as examiners of agricultural machinery, but, in their report, they omitted to notice a small bundle of steel forks, of a very light description, which he obtained from the maker for the purpose of trying them on his farm. It was the fact, that twenty-four men who were employed in digging in his field, at task work, received those forks with perfect ridicule. They were so light, they said, that they might do to throw a little straw into a cart, but they had no value beyond that. He told them to make a trial of them: they did so, and an hour afterwards they quarrelled to see who should get possession of the forks, which effected a diminution of labour to the extent of at least 25 per cent. Since that time he had called attention to the subject through the public journals, and at the present time many thousands of those steel forks were to be found in use throughout the United Kingdom, and there could be no doubt they would have a wonderful effect in the cheaper production of food. They were useful for every purpose of agriculture—even as dung forks, hay or harvest forks, or any other purpose where the arms had to be lifted a great many times during the day—and as the steel fork to which he referred weighed 2 lbs. less than the ordinary iron fork, when they considered the many thousand times a day that the arms of the workmen were lifted, it made a difference of several tons a day to the workman, in addition to which the lighter steel implement possessed a greater power of elasticity, and insinuated itself, by its diminished bulk, where an iron fork or spade could not possibly enter. Although Mr. Wilson had alluded in his paper more particularly to the cutlery manufacture, he (Mr. Mechi) thought a great deal more importance attached to the production of tools. When they considered that the bricklayer's trowel was made of the best steel, the stonemason's cutters, and a variety of other tools, but, above all, saws, files, and various parts of machinery, it was a matter of the greatest importance. What was the use of the great forests, unless they had saws and axes to cut them down. It struck him, during the Exhibition in Paris, that tools formed the most important feature in the productions of Sheffield; and they were so considered by the authorities there, and the award was given to Messrs. Spear and Jackson, who exhibited great superiority in those productions. In fact, Sheffield might be said to be pre-eminent in the department of edged tools, taking the world together. Of course there were some excellent productions in the same department from other nations. Those from Prussia might be said to stand second, in regard to quality and price, and in tools they came very closely upon those manufactured in this country; but, on the whole, he came to the conclusion that there was a neatness and finish about the tools exhibited from this country which gave them the advantage over all others, to say nothing of price. It was quite evident that they were open to competition in the article of steel with any other nation, in regard to the best materials. For instance, almost all the best articles of this country were manufactured from Swedish iron. The iron of this country varied greatly in price, according to the quality. The common cast-iron was bought at from £5 to £6 per ton (he had bought it as low as £4), up to the best Lowmoor iron, at £18 per ton. But Swedish iron was always used for the best manufactures in Sheffield, and the price ran as high as £36 per ton, whilst the steel made in Sheffield was reported to him by a member of an eminent house there, to range at prices varying from £20 to £80 per ton. This brought him to the question of personal and national safety. The best quality of steel, at £80 per ton, was used for the manufacture of swords, and he might add that he wished the same description of material had been used for the trenching tools and the other implements used before Sebastopol, which were as necessary for the success of our armies as the swords themselves. He ventured to say it was a fatal mistake in such things to have any but the very best articles to carry out such an object. He had said that foreigners might compete with this country in the steel manufactures. They could buy the iron in Sweden at the same price as we did, therefore, if they had no import duty, and if their labour was cheaper, talent equal, and machinery and means of inter-communication equal, there was no reason why foreigners should not compete with this country in the production of steel manufactures. To some extent that was really taking place, but fortunately for this country certain other nations had not yet arrived at free trade principles, and, if he might be allowed to say so, were unwise enough to lose the importation of the raw material, thus giving to this country an advantage which it would not otherwise possess. On inquiry of the Paris cutlers what steel they used for their best productions, they told him Huntsman's—the oldest name in Sheffield—that is, Swedish iron converted into steel for use; or that of Messrs. Spear and Jackson, or Turton's, and they paid a considerable duty on the importation of that commodity before they manufactured it. Hence it was quite clear that we had nothing to fear from French competition, so far as price was concerned. But he confessed he agreed to a great extent with Mr. Moulson in his remark that the best descriptions of Paris cutlery were equal to our own; and in the design and carving of the handles he should say they were decidedly superior. That was not his own opinion only. Having had conversations with nearly all the eminent cutlers of Paris with whom he was brought in contact at the late Exhibition, he asked them how it was they had made such advances in their manufactures since 1851? They replied that it was our Exposition of 1851 that had done all this. They said they found they were so inferior in this manufacture to what they imagined themselves to be, that they set to work to make an improvement, and the result was the beautiful quality and polish which they now saw in the French goods, and which did great credit to their perseverance. There were advantages of course in having the best steel as a natural production. That occurred, particularly in Austria and parts of Prussia, and he believed in some parts of Belgium. But the Styrian steel was what they called natural steel—something like the Swedish iron—a very fine production, and that enabled them to have a large trade in Austria in scythes, and other agricultural tools. They were rather roughly constructed, but were nevertheless excellent in quality and efficient in operation. He need not advert to the great superiority of the implements manufactured by Mr. Krupp. He believed the same gentleman exhibited the beautiful cannon which was the object of so much attention in the Exhibition, and it was marvellous to see the fineness of the grain of the metal and the excellence of the finish of the whole of the productions which that gentleman exhibited at the French Exposition. It was evidence not only of a good natural production and of great science in the conversion of the material, but showed a determination to excel, which must ever ensure success. There were, besides, some very neat Swiss productions, in the shape of remarkably fine files, and tools for making the small and beautiful watches peculiar to that country. There were very few fine specimens from Spain, Portugal, Italy, or any other country. Their great rivals were Prussia, Belgium, and France. To show that what he had said relative to the conversion of steel was correct—he would mention that he found a celebrated firm at St. Etienne (Messrs. Pierre Jackson and Co., a house of English foundation) was converting Swedish iron, of the best description, into steel, and so nearly were they approaching our own productions that the Parisian cutlers used that steel in competition with the best Sheffield steel that was converted in this country. He did not agree with the author of the paper, that cheap things should not be made. Many people had very little money to spare, and those who had but threepence could spend only threepence. He had no difficulty in getting samples of the cheap razors, &c., alluded to from Sheffield. Messrs. Spear and Jackson had sent him specimens of table knives and forks, at 1s. 10d. for 24 pieces, and he had no doubt that those who had threepence to spare for a pair of these knives and forks would find them very useful. Another sample were 2s. 1d. the dozen. The razors—which were wrought—not cast, were 1s. 6d. the dozen.

The Chairman.—I think they would scarcely be found of any use.

Mr. Mechi thought they would be found of a certain use. There were scissors which would cut, at 2½d. per dozen! As a proof that foreigners might compete with us if they could get the steel as cheaply as ourselves, he would mention that in the Paris Exhibition some files were shown, very fine and good, and he had ascertained that the English market was supplied with these files. Where the material amounted to only about 15 per cent. of the cost of the article, that is, where the labour amounted to 85 per cent. of the cost, they could supply the English market with those articles, but where the cost of the material formed a greater proportion, they were no longer able to compete with us. But after all it did appear that our great advantage of coal and iron, of railways, of canals, our general machinery and general facilities of intercourse, gave us considerable advantages over other nations who were inferior to us in those respects. Amongst other interesting things he might mention the fact, that an order was given for 2,000 tons of submarine telegraph wire, of the thickness of a tobacco-pipe, at £12 10s. per ton, which order was obtained in consequence of the invention of an ingenious machine for drawing the wire at a small cost, and in extraordinary lengths. Mr. Mechi did not agree with the opinion expressed that Sheffield cutlery had gone back. He thought it exhibited a decided improvement.

The **Chairman** understood Mr. Mechi to say that he considered the cutlery of England had not progressed in the same degree as that of Prussia and other countries.

Mr. **Mechi**—In design and finish of the handles, &c. He would be glad to know if Mr. Mappin had tried hardened gutta percha for knife handles.

The **Master Cutler** (Mr. F. S. Mappin) said he had been much pleased with the very able paper read by Mr. Wilson, stating so minutely the process of manufacturing cutlery in Sheffield. He had also heard read with much regret the letter from the late Master Cutler of Sheffield, the greater part of which had previously appeared in the Sheffield newspapers. So much having been said about the inferiority of Sheffield cutlery, he feared the impression generally would be, that first-class goods were not manufactured as heretofore. This he was fully able to refute by the specimens which he now produced, which, he firmly asserted, no foreign manufacturer could equal. He was further borne out in this by the Cutlers' Company of Sheffield, which was composed mostly of manufacturers of cutlery, who, after fully considering the letter alluded to, passed a unanimous vote that it was contrary to fact. He might say, in passing, that the late Master Cutler was a manufacturer of edge tools, and not of cutlery; therefore his opinion could not, and did not, carry that weight that was supposed by the public generally. The meeting had no doubt been surprised at the very low prices quoted by Mr. Wilson for some of the specimens produced, yet he (the Master Cutler) would assert, that a good razor or penknife could be purchased of the very best manufacture for one shilling, and which would give satisfaction to the buyer. It was certainly plainly finished, but the razor would shave well and the knife retain its keen edge. It was urged that a distinctive mark was required besides the maker's name. Now, the Cutler's Company granted such corporate marks to any maker of knives, razors, scissors, files, or edge tools, on application, and any infringement of such mark was piracy, and the offender on conviction was summarily fined by the magistrate. Run steel scissors were certainly made in large quantities, and were so well finished that it was impossible for any person, unless practically acquainted with the trade, to say they were other than good articles, until they were tested by use. He, therefore, recommended all purchasers of cutlery to see the name and address of the maker was stamped upon each article, and to pay a fair price for it: they would then have a guarantee that what they bought was good. He fully agreed with Mr. Wilson, that there was a great want of a good substitute for ivory and other horny substances, the former of which was very scarce, and had hence become enhanced in value. No attempts to procure a good substitute had as yet been successful. He trusted, however, by the extensive circulation of the *Journal* of this Society, that attention might be drawn to the great want now experienced by the cutlery trade of Sheffield of such a substitute for ivory, and that it would lead to a successful result.

Mr. **Hadfield** (M.P. for Sheffield) said, the Master Cutler had somewhat anticipated the few remarks that he intended to offer on this subject. He thought it a significant fact, with regard to the alleged decline of the trade of Sheffield, that from 1851 to 1856, there had been an increase of population of 24,000 upon a total of 138,000. This, he thought, showed that the trade was not on the decline, or that very large increase of population would not have been attracted there. He regarded the freedom of discussion as one of the most precious privileges enjoyed by Englishmen. They knew their own faults at least, and slight additions were sometimes made to them. He invited them to go to the bottom of the subject. They now had a knowledge of the disease, which, according to the old proverb, was half the cure. There was a parliamentary committee now sitting upon the adulteration of food, which, he believed, would disclose astounding facts. The quantity of poison they were in the habit of eating and drinking, and the adulteration which existed in so many forms, he was sure were calculated to arouse a strong feeling on the subject. Such a statement as Mr. Wilson had given them that evening, he was sure the town of Sheffield ought to thank him for. Let it be published throughout the length and breadth of the borough, and let every man know what was the real state of things, and when they knew it, he thought they would set about to provide a remedy. But he thought, although the public suffered much, yet that they themselves were sometimes in fault in the matter. The government were certainly in fault. They did not go to really responsible parties to obtain the best goods that could be had, neither had they given remunerating prices for the articles they wanted. That was a very serious thing, but the result of a government of routine was bad managers, who got high salaries for doing very little, and that little done by inexperienced and unpractical men. It was suggested by some of his own constituents, that it would be good policy on the part of the government to have some practical man from Sheffield for the purpose of testing the quality of the articles supplied to the government. It seemed as if our army was in danger through the imperfection of the tools they had to use, and on this matter the press of the country, for which he had a profound respect, did the State good service, by laying before the public the whole truth of the case; they might bring bushels of certificates as to the quality of the articles supplied, but the lamentable fact came out that the axes would not cut the timber, nor would the tools supplied to our army stand the severe work of the trenches. The town of Sheffield naturally felt that it was an attack upon the trade of their town, and his constituents desired him to put the question to Mr. Monsell, the Clerk to the Ordnance, with respect to this grave matter; and the answer given was, that none of the articles complained of came from Sheffield. Under these circumstances, what was to be done? He was not accustomed to deal with these articles, and therefore he must theorise rather than speak practically; but he was sorry some remedy had not been provided. It was an excellent suggestion of Mr. Wilson, to call the attention of this Society to the subject. If they would have goods at the lowest price, they could not have them of the best quality, and it must come to that after all. Those ludicrously cheap articles produced before them that evening never could do the work for which they were designed. He thought, if a person had only threepence to spend, he had better not spend it at all for articles like those. It was a difficult question to deal with. The freedom of trade must be allowed for; but it was not yet apparent to him what must be done to induce the production of a good article at a fair price. He repeated that he thought great fault lay with the government; and they were now going to expend enormous sums of money to become manufacturers for themselves, notwithstanding that the Marquis of Lansdowne had said that the government were the worst manufacturers, the worst tradesmen, and the worst cultivators in the world. Yet they had voted several hundreds of thousands for the establishment of government works, to be conducted by government officers. In his opinion, it amounted to a perfect job! If they would allow the legitimate competitors in trade fair prices, they would have the best articles supplied to the army of our country. It was a fearful thing, as the hour of battle drew near, to find that our troops had been supplied with articles of inferior description and manufacture. He had taken the liberty to say thus much, because he thought it desirable that the government of this great country should set a better example; and he believed the manufacturers would do well if they could suggest some better understanding with regard to the testing of the articles supplied for the public service. It was not in one trade merely, but in every trade. The Adulteration Committee, now sitting, would develop a vast deal of valuable information; and he thought it was one of those evils which must be traced to its foundation, and a stringent remedy applied.

Mr. **Mechi** said there was an extensive working of pure iron in Nova Scotia by the Acadian Company, and steel was exhibited at Paris from Australia.

Mr. **Jelinger Symons** said that, whilst engaged in making investigations for the government on the pathology of labour, he was made acquainted with the pernicious effects upon health of the occupation of the cutlery grinders, and had learned that the average duration of life of those so employed did not exceed thirty-five years. He was aware that different expedients had been tried to remedy these effects; but the workmen, for various reasons, had set themselves against them, and therefore the unwholesome state of things continued. He had hoped that the dry grinding would have been superseded by the wet grinding; for he felt more sympathy with the poor workman who had to manufacture these cheap articles than with the persons who bought them. He did not think any legislative enactment would meet the difficulty of the absolute frauds practised in the trade. He thought the only remedy for that was in the old maxim—"*caveat emptor*"—let the public give remunerating prices to the manufacturer, and the chances were that they would get a good article for their money. Let them look to the dealings in base coin. Although the most stringent laws had been passed with a view to check the system, they nevertheless found repeated and continued instances of the practice, and bank-notes still continued to be counterfeited. Mr. Wilson had suggested that a distinctive mark should be put upon cutlery. He thought that was already done.

The **Chairman** said it was only permissive—not compulsory.

Mr. **Symons** added that he thought there was nothing to prevent a manufacturer from putting his distinctive mark upon his own goods; but, at the same time, a man must look for his trade to the superiority of his goods over those of other manufacturers. He thought there was much less necessity for legislative enactment on this subject than in the case of many other articles in which the public were more imposed upon than in the excellent manufactures of Sheffield, in which he hoped they would always maintain their superiority.

Mr. **May** thought something remained to be said upon the point of protective measures either by distinctive marks or something equivalent. The object of making spurious articles was to deceive and defraud both the maker and the buyer, and, therefore, although legislative enactments might not answer the purpose perfectly, inasmuch as a person who would forge a bank-note would not hesitate to counterfeit a distinctive mark, yet some means of punishing the offender might be afforded. Being himself a manufacturer of chronometers, he had hoped to have heard some particulars respecting the manufacture of steel that would have been beneficial to himself; and in the particular branch in which he was engaged he was as much exposed to fraud as any other, and there was no lack of outcry in the present day against his trade as well as that of Sheffield. At the same time he was no more afraid of foreign competition in his trade than in that of Sheffield, inasmuch as he believed British artisans would always maintain the proud position which they held in the manufactures of the world. He thought the native energy and elasticity of the English workmen would always enable them to keep their place in the van. It was very encouraging to hear that the tools found fault with did not come from Sheffield; and they had likewise the satisfaction of knowing that vast numbers of watches bearing the names of English manufacturers were never made in England at all.

Mr. **Varley** was proceeding to offer some observations with regard to the manufacture of steel, when

The **Chairman** said he considered Mr. Varley's observations were scarcely pertinent to the subject before the meeting, which was that of manufactured articles of cutlery, &c., rather than the manufacture of the steel itself.

Mr. **Askham** attributed the superiority of the finish of the handles, &c. of French cutlery, to the fact of the heavy import duty levied upon English goods of that class going into that country. The higher the finish the greater the price and the heavier the import duty. The English cutler manufactured for every market—the French for their own market only. He thought the United States had not sent a good muster of tools to the French Exhibition; but such as were sent he considered were superior to anything produced in Sheffield. The reason was, they used better steel than we did, although they imported it from this country; and augers were imported into this country from the United States made from Sheffield steel. The trade in those articles with the United States was pretty nearly gone, and it was the case he believed to a very great extent with regard to joiners' tools generally. He would say that the trade in chisels, axes, adzes, and in a great measure in saws, with the exception of one or two descriptions, was leaving Sheffield, and had gone to the United States.

Mr. **Mechi** remarked that some beautiful specimens of adzes, axes, augers, &c., were exhibited at the Paris Exposition, from Canada.

The **Chairman** said he could not but express his surprise at some of the remarks which had fallen, tending, as they did, to convey the impression that the cutlery trade of Sheffield was about to leave us altogether. They had seen, for many years, the regular publications of the Board of Trade, showing the amount of exports of manufactured goods from the United Kingdom as compared with former years, and all who had paid any attention to the subject, were well aware that the exports during the last four or five years had gone on increasing in a degree that no one, ten years ago, would have deemed possible, and in that increase the articles of Sheffield had borne a full proportion, or rather more, as compared with other descriptions of staple manufactures. No doubt many bad articles were made for the purpose of being sold, rather than for the use they were, but he doubted whether one recommendation of the paper could be carried out by legislative enactment, and, if so, whether it would tend to obviate the evil. One recommendation was, that every manufacturer of articles made from steel should mark some distinctive design upon them. That appeared to him to be taking such a liberty with manufactures as Englishmen would not submit to. It had been tried in parliament, but the house had refused it; and, if granted, he did not think it would be of any use. Was not all they wanted that John Smith, in addition to "John Smith," might strike a design, and if that design were pirated it would become a legal offence? That was as much protection to John Smith as if John Smith was obliged to strike a design. He agreed with the author of the paper, that in taking proceedings for piracy they might find themselves considerably deceived, but by treating such piracy more in the light of a forgery they would in a great measure overcome the difficulty. He thought there would be a better chance of that plan being adopted, than of compelling every manufacturer to adopt some distinctive mark. With regard to the position in which the cutlery trade of Sheffield stood, he differed from several gentleman who had spoken. He thought it might be that Sheffield did not send so many cutlery tools to the United States as formerly; but it was to be borne in mind that the Americans made tools of the same style, and that on the tools imported into the United States a very heavy import duty was levied. In fact, it might be said that the whole revenue of the United States was raised by the duties levied upon imported goods. That would in some degree account for the exports of those articles falling off, but it would not show the reason for the fact that augers were largely exported from the United States into England. He could only account for this by the fact that the augers of the United States were made by machinery, whilst our own were made by hand, and it was a difference of cost. But when our artizans came to be properly educated, they would see that their own interests were the interests of the country in which they lived, and they would hail the introduction of machinery, which was essential to the country, the town, and the existence of the artizan. On the broad question of the comparison of our goods with those of Prussia and some parts of Belgium—and those were the parts which principally touched upon our heels in competition—we need have no fear. As to France, she had a description of manufacture which we had never attempted to touch; for instance, surgical instruments. Let them be made ever so good in this country, nothing was so highly esteemed by the faculty as a Paris-made surgical instrument, and it was difficult to overcome the prejudice that obtained in their favour amongst the faculty in this country. But as to all other descriptions of cutlery we need have no fear. They made them, it might be, quite as good as we did, but the price put them out of competition. That was not so with regard to many articles of Prussian and Belgian manufacture, and in this respect the manufacture of augers would apply. The effect left on his mind by the two great exhibitions of manufactures, with regard to Sheffield, had been this—that the quality of the Prussian and the Belgian articles was as good as those of Sheffield—that, in a great degree, their usefulness was pretty nearly as perfect, but they wanted finish. This was what he wanted our artisans to take into account, for finish was mere manual labour, and manual labour was cheaper in Belgium and Prussia than in England. If that were the state of the problem—if they could not by other means than manual labour put themselves a-head of Belgium and Prussia in neutral markets, those countries would be in a position to take us by the neck, if not to put us out altogether. They could not do it by manual labour,—it was too dear. It could be done only by machinery, and it was in that that his native town was especially deficient. He was not surprised that the feeling of the artisan was against the introduction of machinery. It was from the want of proper education that that feeling arose; but, as they became better educated, and as they saw their true interests in a truer point of view, they would see that wherever machinery had been largely introduced in trade, with, perhaps, one or two exceptions, the ultimate—if not the first effect—had been that a vast number more hands were engaged in that trade than were engaged in it before the introduction of machinery. The paper before them contained a mass of valuable information relative to a trade of great importance in this country, amounting, he believed, to the extent of £5,000.000 a year; and he hoped some member of the Society would feel it his duty and pleasure to move a vote of thanks to Mr. Wilson for the able manner in which he had brought the subject before them.

Dr. Booth, F.R.S. (Chairman of Council), said he was sure the Council of the Society would be happy to give any practical suggestions, for the protection of the honest trader against the dishonest, their most attentive and serious consideration. He then proposed a vote of thanks to Mr. Wilson for his able and interesting paper, which, having been carried,

Mr. Wilson, in acknowledging the vote of thanks, replied briefly to some of the remarks made during the discussion. With respect to the letter of Mr. Moulson, he gave that gentleman credit for good intentions; but for a practical refutation of his remarks on the decline of Sheffield manufactures, he simply pointed to the specimens before him, none of which had been made expressly for exhibition, but were articles of every-day manufacture. With regard to the remarks of Mr. Mechi, he (Mr. Wilson) had not the good fortune, like that gentleman, to be acquainted with all the productions in steel—from a needle to a dungfork. He had simply introduced what he knew of the subject, not presuming to offer opinions, even on analogous subjects that had not actually come within his experience. What he had said of cutlery would apply to anything made from steel, whether as fine as a needle or as large as a piston. To produce a good article of any kind, it was first necessary to have good materials; and that worked skilfully, would produce the required result, whatever the article might be intended to perform. In reply to the question put to Mr. Symons, he said that forks were still ground upon dry stones. The fan mentioned in the paper was the best remedy ever discovered for the evil consequences of dry grinding. But the workmen, being tenants-at-will, would not provide fans as a fixture on another man's property. That gentleman also made a remark to the effect that buyers should be left to look after themselves. With all due deference, he submitted that they should not. He would take that assembly for an example. It would be no flattery to assume them to be, at least, equal in intelligence to the general public; but if he offered to them an article marked "Rodgers & Sons' cutlery, warranted," would they not reasonably suppose that they were purchasing the productions of that celebrated firm, and they would be justified, though mistaken, in the supposition. Again, he held in his hand a knife marked "J. Rodgers & Sons' Patent, Sheffield," and another, "Rodgers, Cutlers to Her Majesty." Would not one-half of them be deceived by the mark? Not one of the articles he had alluded to had been made by that firm. What he desired of the legislature was, that, if they would not protect the public, they would at least give fair play to the honest manufacturer. He knew of no practical popular test to judge of the quality of steel. Some people thought that by breathing upon a polished article they could tell its quality. If the vapour disappeared rapidly, it was deemed a good sign; but it obviously depended upon the temperature of the steel and the state of the atmosphere. Fracture was a test to some extent, but it was not likely to be adopted by the purchaser. With respect to the quality of steel as a raw material, many persons affected a mystery as to the object for which it was wanted. Let parties state to the steel refiner what it was intended to be used for, and there was no doubt steel might be had suitable to any purpose for which steel could be properly used. In conclusion, he thanked the chairman for his kindness that evening, and begged to acknowledge his obligation to Messrs. Rodgers, Mr. G. Wilkin, and other gentlemen of Sheffield, for furnishing the specimens which illustrated his paper.

The Secretary announced that the paper to be read at the meeting of Wednesday next, the 16th inst., was "On Thread or Fibre Gilding," by Mr. F. Bennoch. On this evening Col. Sykes, F.R.S., will preside.

THE SOCIETY'S EXAMINATIONS AND THE LIVERPOOL INSTITUTE.

Following the example of the Leeds Mechanics' Institute, the Directors of the Liverpool Institute have granted to the School Committees the sum of £20 towards the expense of sending up a limited number of pupils, who may pass a preliminary examination, to the Society of Arts' Examinations in June next.

ROYAL JAMAICA SOCIETY OF ARTS.

The exhibition of this Society was opened, at the Museum Rooms, on the 10th ult., by his Excellency the Governor, who made a brief speech on the occasion, in which he announced that Her Majesty the Queen and His Royal Highness Prince Albert had graciously consented to become the patrons of the Society, and had been further pleased to signify their intention of presenting to the funds a donation of £150.

The exhibition comprised, amongst other things, according to the local *Morning Journal*, a machine for preparing arrowroot, invented by Mr. Clarke, head of the mechanical department of the penitentiary. Also an assortment of specimens of Jamaica ornamental and timber woods, which, though by no means so complete as it might have been, fully illustrated the capabilities of the country to furnish woods for cabinet and building purposes. Among these were a few specimens of mahogany, including the feather, bird's-eye, and wavy varieties. There were likewise a curious natural hat-rack, made from the coratoe, or maypole (*Agave Americana*); lithographic stones from the parish of St. George; hats made from reeds; caps, bonnets, and hats, made from the common corn trash, and a cap made from the celebrated lace-bark; soap, in cakes and bars, made in the country; safety matches, used in the blasting of rocks, made from the pith of the coratoe; specimens of fruits, fishes, reptiles, &c., preserved in spirits, and of the yam-bean, from which an excellent starch is said to be made. The Hanover Branch Society contributed dish-mats, made from the wire-grass, and native grown and cured tobacco.

There was a good collection of ores, including a specimen of copper-ore, taken from a 50-fathom cut—thus refuting the assertion that, in Jamaica, copper is only found in bunches on the surface.

In the assortment of fibres were the following:—Adam's dagger, sea-side mahoe, papaw-tree (*netted fibre*), pine apple, penguin, Jerusalem dagger, Manilla plantain, Chinese plantain, broom-weed, down tree (*netted fibre*), bastard or wild mahoe, burweed, West India ochio, silk grass, common turmeric, Indian shot, common daggar, mountain mahoe, banana, mountain cabbage, lace- bark, and the net of the cocoa-nut.

MULTIPLICATION OF BOOKS AND ENGRAVINGS.

Mr. Charles Knight, in his Report to the Board of Trade, on Class 26, Drawing, Printing, &c., at the Paris Exhibition, thus writes on the above subject:—

"I will endeavour to take a rapid view of the new appliances, as shown in the French Exhibition, which afford the probability of ultimate extension of the copying processes, as belonging to books and engravings, as well as those which, originating in imperfect attempts to produce curiosities, have already formed, or are forming, branches of commerce.

"In type-founding, machinery has been introduced instead of the common mode of casting each letter in a separate matrix. In the great French foundries of Plon and of Laboulaye, as well as in others, many ingenious applications are to be seen. In our own London foundries of Caslon, Figgins, and Bezley, as well as in provincial foundries, we have the most beautiful as well as the most useful modern founts. It is in the adaptation to particular classes of printing that we find the practical good sense of our type-founders, as in most other trades. A type of a different character is required for a newspaper than for a book—a type compact, not too fine, very enduring. This quality of sustaining great and constant wear has been accomplished, in types faced with copper or other metal, by the galvanic process. But this beautiful discovery of electrotyping is producing results which stereotyping has never attained. A cast from type metal, from a woodcut especially, cannot have the sharpness of the original; an electrotype rather adds to the sharpness than diminishes it. The rapidity of the process is also most remarkable in skilful hands. The woodcuts of "The Illustrated News," and of other illustrated papers, are thus duplicated, so as to meet the large demand in a limited time. The large plate of the Austrian types of all languages, thus produced by the galvanic process, was noticed in the Jury Report of the Exhibition of 1851. The same description of plate, with the Calmuck characters added, measuring 540 square inches, was exhibited in 1855. But the Austrian printing-office shows new activity in connection with the capabilities of electrotyping. One of these new processes is called "stilographie." A plane surface is covered with a preparation somewhat like the waxen tablets upon which the ancients wrote. It is composed of two parts of shell-lac and one part of stearine. On this material the draughtsman makes his design with a style. This forms a matrix, from which an electro-type is taken in relief; and from this another plate is taken, which answers the purpose of an incised copper, and is worked at the roller-press. It furnishes a readier mode to the artist than the etching process, but it is scarcely so effective.

"The art called Nature-printing (in German, "Nature-selbstdruk") had not made sufficient advances to be exhibited in 1851. The Austrian printing-office, in 1855, showed to what beautiful and useful purposes it might be applied. The identical reproduction of any natural object—a plant, a feather—by taking its impression on a sheet of lead by an application of cylindrical force, and then producing a galvanic plate which will give impressions of the form, and giving also the colours by separate impressions of the similarly coloured parts, is an onward step in printing which has already taken a commercial shape in England. The admirable plates of Ferns, now publishing by Messrs. Bradbury and Evans, are quite equal to the Austrian examples."

Colonial Correspondence.

SHIPBUILDING IN THE WEST INDIES.

Georgetown, Demerary, 5th March, 1856.

SIR,—Allow me through your columns to draw the attention of the shipbuilders in England to the advantages of building ships in this colony, avoiding, thereby, the intermediate charges. The accompanying sale of six ships' cargoes, sold in Britain, on account of my firm, exhibit:—

Date of Sale in England.	Amount paid by the Purchaser.			Freight paid to the Ship.			Insurance and other Landing Charges.			Amount paid to Producer.			Name of Ship.
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	
1850—Sept.	844	2	8	405	7	3	89	9	6	349	5	11	Gazelle.
1851—May.	1042	16	9	689	11	11	101	9	10	260	15	0	Mohaica.
" Nov.	1229	10	11	573	10	0	129	7	9	526	3	2	Ann Wise.
" Nov.	1279	15	5	644	19	4	141	4	8	493	11	5	Victoria.
1852—Jan.	394	3	6	246	10	2	67	3	6	80	19	10	Aurora.
" Sept.	1517	12	6	849	15	0	204	14	10	463	2	8	Millman.
	6308	1	9	3400	13	8	733	10	1	2173	18	0	

Thus, the purchasers paid in England,		£6,308 1 9
The ships received freight,	£3,400 13 8	
Insurance commission and landing charges amount to	733 10 1	
Nett proceeds left for the producer	2,173 18 0	
	£6,308 1 9	£6,308 1 9

During the years 1848-49-50 and 51, we loaded twenty-three ships with timber for England, but with no better result, still the freights and landing charges continued the same; but since 1851 we have cut and sold a large quantity in the colony at 1s. 7d. sterling per cubic foot for shipment, but as the purchasers grumble at this rate, I am induced to enlighten the shipbuilders on the subject, they paying so much, and the producers getting so little. I think if we could come somewhat closer to each other, the intermediate charges, which fall to the share of the "ship" or the "charterer" (I do not know which, as these vessels are generally chartered for a sum out and home), would reduce the cost of the wood to them, and give us something better. There are on the banks of our rivers immense forests of greenheart, mora, silverbally (a hard wood, considerably lighter than the two first—long, straight, and well suited for planking), souwarie, with natural crooks, locust, wamara, an endless variety of furniture woods, and many soft woods, equal to American pine, the export of which the intermediate charges prohibit.

It may be said that the colony can only furnish the wood required; that the freight out of canvass, iron, nails, rope (bye-the-bye our fibres would come well in for that), &c., would swamp the saving effected on the timber, but outward freight can be had cheap enough, at an infinitely less rate than homeward on an average, for the producer of sugar, as well as the timber shipper, pays the bulk of the charter. However, the purchasers in England can estimate the intermediate charges by what they pay, taking the price of wood in the colony at 1s. 7d.

Timber can be obtained throughout the whole year, and a ship drawing 15 feet of water can load at a distance of 70 miles up the river Demerary, in the very heart of the timber country, and a shipbuilder located there would be possessed of the following advantages:—He would be able to order his wood to the dimensions he wished, from vast forests adjacent to his building dock, natural breast hooks and timbers, which, from their form, no vessel can carry on freight, plenty of "water power" to drive his saws, and the waste wood at present left to rot in the timber paths, would come in for treenails and many other useful purposes. He could depend upon an inexhaustible supply of timber, and by having half-a-dozen competent men from England, to act as foremen, he would be at no loss for labourers, as the creoles are apt hands, and many fine schooners have been built in the colony. The average rate of wages is 4s. per diem for the best hands, and he would get intelligent young hands, *ad libitum*, eager to learn the desirable trade or art of shipbuilding. The climate in the upper parts of the rivers is far preferable to that of Georgetown or the adjacent coast, and well adapted for European constitutions; yellow fever unknown; the beautiful creek water is most wholesome, and affords delightful bathing; the rivers and forests abound in fish and game, are free from mosquitoes that infest the town and coasts.

The cost of permission to cut wood on 500 acres of crown land, is, viz., for a diagram, 100 dollars; Government fees, 136 dollars; in all about £50, with an annual rent of eightpence per acre. I do not profess to have much knowledge of shipbuilding; and there may be objections to building on the spot, which I am unacquainted with; however, should this letter convince the purchasers of our excellent greenheart in England, what a small proportion of the price paid by them falls to the share of the wood-cutter or producer here, it may suggest some plan for their mutual advantage.

I am, Sir, your obedient servant,
LEWIS CAMERON.

Home Correspondence.

THE RIGHTS OF LANGUAGE.

Sir,—Should Mr. Archer ever chance to visit a *pulperia*, or grocer's shop, in Buenos Ayres, Luxan, San Luis, Mendoza, San Juan, Cordova, Tucuman, Salta, Jujuy, or any part of Chilé, and ask for a *maté*, the pulpéro will hand him over the counter a gourd, or silver imitation thereof, either full or empty. If he needs the herb, he must ask for *yerva*.

It is quite true that foreigners, *i. e.*, Englishmen and Yankees, call it, and frequently spell it, *mattee;* but this mode of speech is akin to the cockney, "take a pot," or "drain a pewter." The term *yerva maté* is occasionally used by natives, but it means, in that case, *herb for infusion*.

Maté is not a Spanish word, and most provincial words in Southern America are of Indian origin, I therefore judge it to be Indian. A Spaniard calls a pig *puerco*, a Chileno calls it *chancho*.

I am aware how difficult it is to change a name dubbed by commerce, but still an attempt should be made, where practicable, to keep language pure. We call Spanish American dried meat "*jerked beef.*" In Spanish it is *charqui*, a corruption from the French *chair cuit*, *i. e.* dried or cooked flesh. A common shopkeeping name in France is *charcoutier*, who is usually the sausage man.

We call a thieving long-shoreman on the Western shores of the Atlantic a fillibuster, who has a very droll etymology. The early boucaniers, or bucaniers, and then buccaneers, *i. e.* literally *bacon-makers*, from drying the wild swine of Tortuga, or Tortoise island, when driven out by the Spaniards, became *freebooters* on the salt water. The French, always in a fix with English pronunciation, smoothed the harsh sound into *flibustier*, the Spaniards into *filibustero*, and the coarser Anglo-Saxon, too blunt to restore it to its original, calls it now a *fillibuster*, and occasionally shortens it into a "buster;" and "goin a fillybustin," is the romance of rowdyism, just as going a philhellening was erewhile the romance of universities.

Chilé, pronounced Cheèlay, we obstinately write Chili, and call it Chilly.

Paraguay was a Spanish settlement, and when the infusion travelled over the border into Brazil, it is quite possible that the Portuguese called the herb by the name of the cup, and, if a Spaniard remonstrated with them for it, would be quite likely to "make an ugly face at the enemy," according to their military word of command, and persist in defying the provincial Spanish.

I really must put it to Mr. Archer whether he would be willing to sanction adulterated tea, and, if not, why should he sanction adulterated language? The South Americans are not of the "noble race of Shenkin," but, at any rate, let us leave their fine old bastard Latin uncorrupted by the vulgar abbreviations of Saxon commerce, even though we "civilise themselves from the face of the earth."

Yours faithfully,
W. BRIDGES ADAMS.

THE DEPRECIATION OF MANUFACTURES.

Sir,—Every succeeding paper read on trades and arts within your arena tells us "how shocking bad the articles are now-a-days," and what infamy is practised in their production. I take it that this very much overstated evil is a natural sequence from two circumstances. First, the substitution of middlemen, or distributers, between the producer and consumer—a necessary condition of a highly artificial state of society of dense numbers; and, secondly, the fact that humanity is made up of a few wise men, a considerable number of shrewd men not over conscientious, a very large number of foolish men, and a great general mass of ignorant men. From time immemorial, the shrewd, unconscientious men have been accustomed to prey on ignorant men and fools. They are the pikes amongst the gudgeons and flat-fish. Pills, and razors, and strops, and shirts, &c., are the baits wherewith they angle, from Packwood down to Morrison. In a dense city, a man buys a cheap article, tempted by apparent saving, and with the inward conviction that if it fails he can get another. In the western woods of the United States, he will take care to purvey him a proven axe, because he cannot there get another. In the days of Robin Hood, the tanner, butcher, or other, purchased his Sheffield whittle, wherewith to flay his "capul hide," direct from the working cutler—mostly to order—so that he got something that really would cut. He was a capable tanner, dealing with a capable whittle-maker, and would probably have exacted the penalty of a faitour whittle-maker's ears for failing in his bargain. In modern times, by the middleman process, this kind of personal satisfaction is out of the question, and the only mode of dealing with the evil is to lessen the numbers of the ignorant by education. Make it a part of their education to judge rightly of the tools and instruments they have to use, and they will know how to select the right ones. Scissors and knives that won't cut can only be regarded as the toys of grown babies. Natural fools will always remain, but when ignorance ceases, the fools will be more under protection, and the unconscientious shrewd men will find that their trade won't pay—that they themselves are only "fools with a circumbendibus." Mr. Wilson could, probably, have given us some curious histories as to the origin of a trade process for keeping up wages, peculiar to Sheffield, called "rattening," for that is part of the business of cutlery—blowing up a mill or boiler with gunpowder as a summary punishment for infringing trade prices.

Personally I have no interest in razors to mow down beards, having learnt from Indians and others how to substitute erasers for them, plucking out and cutting away superfluous hair, but I have been occasionally applied to, in the adjured name of the Virgin, to bestow the power of cutting on a cast-iron razor, with Sheffield mark, and an edge analogous to a corn sickle. It would be curious to find that the adulterators had been adulterated—a Sheffield swindler pirated by a German swindler. There is great pleasure in paying a Jew with a bad sixpence for a warranted—*mori Judaicæ*—black-lead pencil. I have seen a man shave himself with a French long clasp-knife in preference to an English razor. Your audience was too impatient with Mr. Varley. Walby, the trowel maker, was a conscientious workman, who was formerly an enchanted smith in the imaginations of London bricklayers, who paid 50 per cent. more for the Goswell-street manufacture than for any shop trash. Public house tenders were made to suffer being cut to pieces in wagers by the magic weapons. The producer and consumer met face to face and each was proud of his craft. One of our most noted writers is ever crying out for a pair shoes—real shoes—the like of which are never made now. Shoes of old were made to wear, but now to sell only.

We must bear with our evils. Middlemen and uneducatedness together scoff at conscience. Education will put a bit in the mouth of the middleman, and make him a useful hackney.

CHALYBS.

Proceedings of Institutions.

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Bedford.—The annual meeting was held on Monday, the 31st ult. Mr. James Wyatt, V.P., occupied the chair, and, having briefly introduced the business of the evening, called on Mr. Coombs, the hon. secretary, to read the report, of which the following is a brief abstract:—After congratulating the members on the favourable position the Institution maintains, the committee express their obligations to Lord C. J. F. Russell for a lecture at the commencement of the session, on "The Normans and Normandy;" also to the Rev. Emilius Bayley, Incumbent of Woburn (now Rector of St. George's, Bloomsbury), for a lecture on "The Turkish Empire;" to W. K. Norway, Esq., of London, for a lecture on "The Feudal System;" to J. S. Trelawny, Esq., on "The Maxims of Rochefoucauld;" to C. E. Prior, Esq., M.D., for a lecture on "The Food of Man;" to the Rev. E. Goodenough Bayley, for a lecture on "Character;" to the Rev. H. J. Rose, for a lecture on "Genghis Khan and the early Kings of Tartary." Mr. E. Wheeler gave an interesting lecture on "The Curiosities of Insect Life." The library had received much attention during the year, and a very large proportion of income, amounting to £42 8s. 9d., had been expended in the purchase of books of standard value. There was now a good supply of these, in the various departments of literature:—history, biography, science, travels, as well as of the best works of fiction, so that members who availed themselves of its use would find in it alone an equivalent for the full amount of their subscriptions. The fortnightly meetings were resumed at the commencement of the session, and papers were given on "The Life of Oliver Goldsmith," by Mr. Sewell; on "Chemistry, with experiments," by Mr. Sergeant; on "The Plurality of Worlds," by Mr. J. Dixon, jun. Other papers were promised by members, but had been postponed for the present. The formation of a natural history class, free to the members, had been projected, under the direction of the mayor and Mr. Blower. The committee were strongly of opinion that much good would result from the formation of classes in the various departments of science. The want of suitable rooms was the main difficulty in the way. Judging, however, from the friendly disposition evinced towards the Institution by many who had watched its course from the commencement, the committee were of opinion that a vigorous canvass for contributions would be cordially responded to by the public, and the funds necessary for the erection of an appropriate building might be speedily raised. The Institution had conferred most important benefits on the town, and now, in the tenth year of its existence, might be regarded as having passed successfully through its probationary stage. The committee gratefully acknowledged a subscription of ten guineas from William Henry Whitbread, Esq., to the funds of the Institution. To other honorary subscribers the committee expressed their continued obligations. There are now 150 members, of whom 84 are annual, and 66 quarterly subscribers. The income of the Society, during the year, amounted to £135 16s. 8d., and the treasurer, Mr. Thompson, reported a balance in hand of £9 6s. The chairman called attention to the report, and more particularly to that paragraph which suggested a movement for the erection of appropriate rooms. This led to a discussion, and ultimately the matter was referred to the committee for further consideration. A vote of thanks to the secretary and librarian (Mr. Sewell), moved by the chairman, and seconded by the mayor (George Hurst, Esq.), was unanimously carried.

Brechin.—The annual meeting of the Mechanics' Institute was held on the evening of Monday, 7th April. Mr. James Smart, President, in the chair. The Secretary, Mr. Picken, read the report of the state of the affairs of the Institution, which showed that the Institution was in full efficiency, ministering in no slight degree to the promotion of intellectual improvement, by placing within the reach of all, the means of acquiring useful knowledge, and of spending their leisure hours profitably and agreeably. During the past year the interest taken in the objects of the Institution has continued unabated. There has been a slight increase in the number of members, the numbers being 370 against 364 last year. The number of life members has been increased by the addition of two names—those of John Chalmers, Esq., of Aldbar, and William E. Baxter, Esq., M.P. The practice of having the more active business of the session begun with a musical concert, was this year departed from, and, instead, Mr. W. E. Baxter, M.P., gave an address on "Books and Study," which was delivered to a crowded audience, and gave universal satisfaction. The other lecturers were the Rev. William Allan, Arbroath, (1); Dr. Samuel Lawrence, Montrose, (1); Mr. Donnan, Montrose, (1); Mr. William E. Hughes, London, (2); Mr. Dove, Edinburgh, (2); Mr. James A. Campbell, Stracathro, (1); and the Rev. A. Gardner, Brechin, (1). The subjects discoursed on were "Books and Study," "The Electric Telegraph," "The Laws of Health," "Music," "The Black Sea and the Baltic," "The Wild Sports of Scotland,' "The Catacombs of Rome," and the "Progress of Civilization in this Country." The directors, with the object of combining amusement with instruction, secured for the members admission at half-price to the musical concert given by the Hungarian band, and to the entertainment of natural magic of Signor Bosco. The library, the department of the Institution that continues to enjoy the largest share of popularity and patronage, is at present in a most flourishing condition. The books, amounting to nearly 3,000 volumes in all departments of science and art, have been in active circulation. The number of readers during the past session has been 340, and the number of volumes issued during the same period has been 6,230, giving on an average 19 volumes to each reader, though some range as high as 80, and some as low as 3 or 4 or even 1. Though books of an imaginative cast, and usually characterised as light reading, have been most in demand, many others, whose study, while requiring more severe application, and more concentrated attention, subserves the important end of strengthening and invigorating the mental faculties, have by no means been neglected. The additions to the library have not been so large as those made last year. To this various causes have combined. The total number of books added to the library during the session has been 61—17 by donation and 44 by purchase. The donors were—Lord Lindsay, the author of "The Lives of the Haldanes" (2 copies), the authors of "The Patentees' Manual," the author of "Rimes and Poems," and the Society of Arts. The newsroom has had during the past session a large number of subscribers, which was to be expected from the stirring events which were then daily transpiring. The report then brought before the members the advantage derived from connection with the Society of Arts, of London, which now has 411 Mechanics' Institutions in union with it. Special reference was made to the scheme set a-going by this Society for granting certificates on examination to members of the Associated Institutions, and thus encouraging and stimulating the formation of classes for instruction. The income of the past year was £111 4s. 3½d., and the expenditure £85 19s. 11d., leaving a balance of £25 4s. 4½d. in the hands of the treasurer.

Huddersfield.—The Monday Class Lectures of the Mechanics' Institution continue to attract large numbers to the reading classes, nearly all of which are held on the Monday night. Recently the adult classes were assembled in No. 6 room, which is about being enlarged, to accommodate the numbers now thronging to it. Here Mr. William Marriott, one of the vice-presidents, gave the first of a series of lectures on the subjects treated in Johnston's "Chemistry of Common Life." Every fortnight, for some months to come, this series of lectures will be continued. To the senior youths, about one hundred of whom were assembled in No. 3 room, Mr. Meikle gave the first of a series of readings from our standard authors. On this occasion the poet chosen was Shakspeare; Mr. Meikle's selections were from the historical plays. The junior classes, which also met in very large numbers, listened with attention to a conversational lecture delivered by Mr. Dore, "On the Early History of the Earth." At the close of his continuous remarks, Mr. Dore began to talk with his hearers as to their remembrances of the facts brought before them, and their relative connection in their minds. The answers given were prompt and clear, and sometimes racy, too, from the humour with which the idea had been seized, or the Yorkshire idiom in which the thought had been thrust home upon the questioner. —A meeting of the Committee and Teachers of the Mechanics' Institution was recently held in the saloon of the Institution. About two-thirds of the officers were assembled, and from forty to fifty of the teachers. Mr. Edmund Eastwood, the president of the Institution, occupied the chair. The subjects brought before the meeting came before them in the following order:—1. The propriety of obtaining better class books. The president announced that the Irish Society's Arithmetic and Grammar would be introduced, and at so cheap a rate that every pupil in the institution might become a purchaser. The subject next introduced was the classification of the writing classes, a restriction to the use of large and round-hand in the junior class-rooms being the principal point to which attention was directed. The discipline of the school next came under discussion, Mr. Heseltine urging it upon the attention of the meeting, and the president remarking that it was one of his highest sources of satisfaction to find that year by year the teaching of the Institution so directly resulted in an improved tone of morality. Mr. Hiley then introduced the question of forming a voluntary teachers' class, which he warmly advocated, the secretary explaining that the specific object of the class was to obtain, whenever it was possible, better modes of teaching. A resolution, requesting the committee to form such a class, moved by Mr. Heaton and seconded by Mr. T. Berry, was carried unanimously. The possibility of forming a class for the special study of natural philosophy next succeeded as a topic for discussion, and there is little doubt that the ground is now fairly broken, and at no very distant time such a class will be inaugurated under the auspices of the working men themselves, bringing their home-made apparatus. The raising, upon the present school of the Institution, a higher school, was then discussed. It was stated that the advanced drawing-class might at once form part of the high school. The class, from the character and number of the drawings required, was a costly one, and there was no objection on the part of the pupils to contribute to the expense. A small fee would be cheerfully paid by them. The president remarked that the plan had been adopted in the French class with perfect success, increased numbers and regular attendance resulting. The president then invited the attendance of the teachers to a very important subject, the present crowded state of the class-rooms; and it appeared to be the general impression that such an addition would be necessary as would necessitate an appeal to the public for aid.

London.—The first annual meeting of the Camden Literary Institution was held on the 25th ult., and was presided over by M. A. Garvey, Esq., LL.B., one of the vice-presidents. The meeting was numerously attended, and the entertainments, which comprised both literary and musical variety, passed off most satisfactorily. The chairman gave an interesting description of the process of Nature Printing, illustrating his remarks by exhibiting specimens of the plates employed in the process and impressions taken from them, kindly lent by Messrs. Bradbury and Evans, together with specimens belonging to the Society of Arts, also lent for the occasion. At a later period of the evening a short address, on the Microscope, was given by John Gamgee, Esq., medical lecturer at the Institution, who created a fund of amusement by exhibiting three powerful microscopes in one of the class rooms. Miss Poole, Mrs. A. Gilbert, Mr. Geo. Tedder, Mr. Fred. Chatterton, Mr. Henry Baumer, Mr. Aylward, Mr. W. Dawson, and Master Haynes, kindly gave their musical services, and elicited marked applause. Several rooms were decorated with paintings, contributed by Fred. Goodall, Esq., A.R.A., Geo. Lance, Esq., Geo. Cruikshank, Esq., J. Absolon, Esq., and others, also with some beautiful photographic portraits, exhibited by Messrs. Aglio and Absolon, of Piccadilly, and Mr. Mayall, of Regent-street. The London Stereoscopic Company contributed an interesting collection of stereoscopes and slides, and Mr. Geo. Gray, and Mr. F. C. Partington, lent several working models. The committee report favourably of the prospects of the Institution. The numbers continue to increase, the lectures, reading-room, and classes are well attended, and the library, though small, is well used. Of course the committee need encouragement and co-operation; they are, however, gratified at having hitherto met with both beyond their expectations.

Tunbridge.—The annual general meeting of the Literary Society was held on Monday, the 7th instant, Major Scoones, the president, in the chair. The secretary, Mr. Snelling, read the report, containing a statement of receipts for the year ending 31st March last, amounting to £107 18s. 8d., and the expenditure for the same period, £105 15s. 8d., thus leaving a balance in the hands of the treasurer of £2 3s. 0d. It was also reported that the lecture account for the season showed a balance in favour of the Society. The number of books in circulation from the library amounted to 1,049 in the course of the year. The following gentlemen were appointed to form the committee for the ensuing year, viz., Messrs. Biggs, Bartram, Headland, Ellis, Kirkland, Gregory, J. Smith, Wibmer, and Calvert. The meeting separated with a vote of thanks to the chairman.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 3rd April, 1856.

Par. No.
41. Local Acts (20, Kirkwall Harbour Amendment; 21, Inverness and Aberdeen Junction Railway; 22, Morayshire Railway; 23, Middlesbrough Extension and Improvement)—Admiralty Reports.
85. St. James's Park—Report from the Committee.
90 (5), Civil Services Estimates—Class 5.
113. Highland Roads and Bridges—42nd Report of the Commissioners.
75. Bill—Reformatory and Industrial Schools.
National Education (Ireland)—21st Report of the Commissioners, Vol. 2.
Census of Ireland for the year 1851 (Ages and Education)—Part 4.
Major-General Williams—Fac-simile of the Superscription of a Letter by Shukri Pasha.

Delivered on 4th April, 1856.

91. Civil Contingencies—Account and Estimate.
121. Factories—Copy of Instructions.
132. House of Commons' Offices—Copy of a Treasury Minute.
77. Bills—London Corporation.
79. Bills—Public Works.
80. Bills—Public Works (Ireland.)
Statistical Abstract of the United Kingdom from 1841 to 1855.
Education—Minutes of the Committee of Council.

Delivered on 5th and 7th April, 1856.

114. Irish Reproductive Loan Fund—Account.
116. British Spirits—Returns.
118. Banks of Issue—Return.
119. County Court Judgments, &c.—Return.
125. Enfield Factory—Return.
127. Education—Copy of Minute, Dated 26th January, 1856.
130. Immigrants and Liberated Africans—Return.
131. Church Affairs (Canada and Victoria)—Correspondence.
108. Mr. L. H. Evelyn—Copy of Correspondence, &c.
123. Convicts (Ireland)—Returns.
135. Exchequer Bills—Account.
136. Committee of Selection—4th Report.
62. Bills—Tithe Commutation Rent charge.
63. Bills—Advowsons (a corrected copy).
76. Bills—Courts of Common Law (Ireland) (amended).
81. Bills—Leases and Sales of Settled Estates.
78. Bills—Scotch and Irish Pauper Removals.
82. Bills—Joint Stock Banks.
85. Bills—Fire Insurances.
86. Bills—Bankers Compositions.
Turnpike Trusts—2nd Report by the Secretary of State.
Prisons—17th Report of the Inspectors (Home District) Part 1.
Prisons—18th Report of the Inspectors (Home District) Part 1.

Delivered on 8th April, 1856.

111. Increase and Diminution (Public Offices)—Abstract of Accounts.
139. Board of Manufacture (Scotland)—Papers.
126. Military Aid to Civil Power—Returns.
124. Poor Law (Birmingham and Aston)—Report by R. Weale, Esq.
87. Bill—Joint Stock Companies (as amended in Committee and on Re-commitment).
Charity Commission—3rd Report.

Delivered on 9th April, 1856.

41. Local Acts (24, Stotfield and Lossiemouth Harbour; 25, Stockton and Middlesbrough New Turnpike Road and Bridge)—Admiralty Reports.
115. Expiring Laws—Report from Committee.
117. New Palace (Westminster)—Correspondence.
137. Bank Notes—Copy of Treasury Minute.
83. Bills—Specialty and Simple Contract Debts.
88. Bills—Bankruptcy (Scotland) (amended).
89. Bills—Drafts on Bankers (amended).
92. Bills—Partnership Amendment (No. 2).
Prisons—21st Report of the Inspectors (Scotland) Part 4.

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. Lankester, "On the Recent Progress of Vegetable Physiology."
Architects, 8.
Geographical, 8½, 1. "Letter to the Secretary from Dr. Sutherland, Natal, South Africa;" 2. "Later Accounts respecting Dr. Livingston, and Return Route of the Arab Merchants across Africa;" 3. Mr. Thomas Hopkins, "On Certain Arid Districts and the Causes of their Dryness."
Tues. Royal Inst., 3, Mr. T. H. Huxley, "On Physiology and Comparative Anatomy."
Civil Engineers, 8, Discussion upon Mr. Drysdale's paper on "Steep Gradients of Railways, and the Locomotives Employed."
Linnæan, 8.
Pathological, 8.
Wed. Society of Arts, 8, Mr. F. Bennoch, "On Thread or Fibre Gilding."
Entomological, 8½.
Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.
Fri. Royal Inst., 8½, Dr. H. Bence Jones, "On Ventilation, and the Means of Determining its Amount."
Sat. Asiatic, 2, Mr. C. P. Brown, "On the Present State of the Hindu Population of India, with some Notice of the Mahommedans."
London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements; their Manufacture and Application."
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette April 4th*, 1856.]

Dated 22nd December, 1855.

2899. John Gedge, 4 Wellington-street South, Strand—Improvements in cutting and folding paper to form letters or notes and envelopes in one piece. (A communication.)

Dated 14th February, 1856.

377. John Conrad Meyer, Paris—Improvements in machinery for rolling metal.

Dated 27th February, 1856.

501. William Holden Jennings, Birmingham—Improvements in the manufacture of the guards and heel plates of guns, which improvements may also be applied to the manufacture of lasso rings and manillas.

Dated 1st March, 1856.

537. François Rualem, 29, Rue de Paris à Belleville, France—Improvement in the manufacture of fuel.

Dated 4th March, 1856.

550. Charles Thomas Rosenberg, 12, Clarence-terrace, Camberwell New-road—Improvements in ornamenting china, glass, and other surfaces, when transferring printed impressions.

Dated 17th March, 1856.

634. George Hills, Belmont-hill, Lee—Improvements in treating fatty and oily substances so as to obtain stearine and oleine in separate states.
636. James Amos, Frindsbury, Kent—Improved flour dressing machine.
638. Robert Thomson, Glasgow—Improvements in weaving.

Dated 18th March, 1856.

640. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Improvements in churns. (A communication.)
642. Thomas Bird and Thomas Rose, Manchester—Improvements in castors.
644. Edwin Pettitt, Manchester—Improvements in machinery for preparing cotton and other fibrous substances.
648. William Smith, 10, Salisbury-street, Adelphi—Improvements in the means of economising heat in locomotive engines. (A communication.)

Dated 19th March, 1856.

651. Richard Morgan, Acton—A cellular purse.
652. Thomas Richardson and George William Jaffreys, Hartlepool—Improvements in marine steam-engines.
653. Augustus Dacre Lacy, Hall-house, Knayton, near Thirsk—Improvements in certain apparatus for taking up and delivering mail bags and other packages from a railway carriage or carriages whilst the train is in motion.

654. Barnet Solomon Cohen, 9, Magdalen-row, Great Prescot-street—Improvement in the manufacture of chimney pieces, shop fronts, pillars, pilasters, slabs, vases, and ornamental parts of buildings.
655. John Davie Morries Stirling, Blackgrange, Clackmannanshire, N.B.—Improvements in steel and its manufacture.
656. Barnet Solomon Cohen, 9, Magdalen-row, Great Prescot-street—Improvement in the manufacture of pen-holders, handles, knobs, finger-plates, and umbrella and parasol furniture.
657. Ely Smith Stott, Halifax—Improvements in the manufacture of mohair, alpaca, and worsted pile fabrics.
658. David Cope, Birmingham—Improved manufacture of spoons, forks, and ladles.
659. Alfred Vincent Newton, 66, Chancery-lane—Improved means for separating substances of different specific gravities. (A communication.)
660. John Bishop Hall, New York—Improvements in preparing and treating pictures.
661. Charles Frederick Parsons, Lambeth—Machinery to be employed in the bleaching and dyeing of cloths, yarns, and fabrics.
662. Richard Archibald Brooman, 166, Fleet-street—Improvements in balance slide valves. (A communication.)

Dated 20th March, 1856.

663. John Leighton, 40, Brewer-street, Golden-square—A luminous fire-place and self-supplying smoke consumer.
664. Peter Armand le Comte de Fontainemoreau, 4, South-street, Finsbury—Improvements in looms for weaving. (A communication.)
665. James Wadsworth, Hazelgrove, near Stockport—Improvements in the ventilation of mines, or in the means of removing noxious gases therefrom, and in machinery or apparatus to be used for that purpose.
666. John Watson Burton, Eye, Suffolk, and George Pye, Ipswich—Improvements in treating flax, hemp, and other fibrous matters requiring like treatment.
667. William Charles Theodore Schaeffer, Bradford—Improvement in treating soap-suds and wash-waters.
668. John Davie Morries Stirling, Blackgrange, Clackmannanshire, N.B.—Improvements in mounting heavy ordnance for naval purposes. (A communication.)
669. John Trueman, 34, Castle-street, Belfast—Improvements in ovens for baking.
670. William Drummond, Smith-street, King's-road, Chelsea—Improvements in spring hinges for swing doors.

Dated 22nd March, 1856.

671. James Murphy, Newport—Improvements in means or apparatus for stopping or retarding vehicles used on rail or other roads, which improvements are also applicable to the brake wheels in connection with stationary engines.
672. George Henry Brookes, Dalkeith—Improvements in stoves, grates, or fire-places.
673. William Brierley and James Platts Brierley, Cleckheaton—Improvements in looms for weaving.
674. Walter Glover, Salford, near Manchester—Improvements in the construction and arrangement of machinery or apparatus for damping and beetling woven fabrics.
675. Henry Pratt, Worcester—Improvements in the construction of union mills, and in the application of the motive power apparatus, and machinery connected with the manufacture of flour and bread, parts of which are also applicable for other useful purposes.
676. James Septimus Cockings, 36, Ann-street, Birmingham—Improved envelope, and which said envelope he proposes designating as the despatch or return envelope.
677. John Henry Johnson, 47, Lincoln's Inn-fields—Improvements in weaving by electric power, and in the machinery or apparatus employed therein. (A communication.)
678. John Jones and Alexander Cunningham Shirreff, Glasgow—Improvements in the construction and application of rotatory motive power engines and pumps.
679. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in electro-magnetic printing telegraphs. (A communication.)
680. Henry Brierley, Chorley—Improvements in self-acting mules for spinning and doubling.
681. John Hinks and George Wells, Birmingham—Improvements in metallic pens and pen-holders.
682. Gustav Georg Anton Ludwig Michael Schelhorn, Birmingham—Improved pen-holder.
683. Charles Carey, 32, Union-grove, Wandsworth-road—Improvements in shower baths.
685. Charles Carey, 32, Union-grove, Wandsworth-road—Improvements in the vessels and filters used for making infusions of coffee and other substances.
686. John Juckes, Dame-street, Islington—Improvements in furnace bars.
687. Charles Carey, 32, Union-grove, Wandsworth-road—Improvements in presses for copying letters and other documents, and for other uses.
688. Edmund Barber, Tring, Hertfordshire—Improvements in mangles.

Dated 24th March, 1856.

690. Thomas Heaton, Blackburn—Improvements in self-acting doors and gateways.
691. James Bryant jun., Plymouth—Improvements in machinery or apparatus for the re-burning of animal charcoal.
692. James Robertson, Ardrossan—Improvements in transmitting motive power.
694. Peter Brown and George Brown, Liverpool—Improved ash-pan for fire-grates.
695. Richard Husband, Manchester—Improvements in the manufacture of hats.
696. John Tysoe, Charles Tysoe, and Peter Foxcraft, Salford—Improvements in machinery or apparatus for roving, spinning, and doubling cotton and other fibrous substances.
697. William Pitt and Edwin Turner Davies, Birmingham—Improvements in the manufacture of brackets and castors for furniture.
698. William Clay, Liverpool—Improvements in the manufacture of wrought or bar iron.
699. William Edward Newton, 66, Chancery-lane—Improved coupling for connecting carriages, locomotives, and all vehicles used on railways. (A communication.)
700. William Edward Newton, 66, Chancery-lane—Improvements in cranes. (A communication.)

Dated 25th March, 1856.

701. Robert Caunce, Bolton-le-moors—Improvements in the machines for spinning called 'mules.'
703. Louis Antoine Gizard, 33, Rue de l'Echiquier, Paris—Improvements in elastic mattresses and cushions.
705. William Forster, Black Dike Mills, Bradford—Improvements in looms for weaving.
707. John Dearman Dunnicliffe, Nottingham, and Stephen Bates, Radford, Nottingham—Improvements in the manufacture of twist lace and weavings.
709. James Hargraves, Woollen Works, Carlisle—Improvements in the apparatus used for dyeing fabrics.
711. William Ball, Chicopee, Hampden, U.S.—Improvements in machinery for stamping ores.
713. William Illingworth, Manchester—Improvements in printing or colouring china, earthenware, or other ceramic manufactures, and in the machinery or apparatus connected therewith, and also improvements in the subsequent treatment of such manufactures.

INVENTION WITH COMPLETE SPECIFICATION FILED.

739. Constant Jouffroy Duméry, Paris—Improvements in smoke-preventing apparatus.—27th March, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed April 4th, 1856.
2230. Thomas Dickens.
2242. John Hubbard.
2250. Joseph Gilbert Martien.
2268. Denis Hébert.
2282. Thomas Moore.
2318. Jules Hyppolite Clément.
2334. John Wakefield.
2340. John Davie Morries Stirling.
2354. Thomas Valentine and Daniel Foster, and Giles Haworth.
2400. John Davie Morries Stirling.
2642. John Pursloe Fisher.
2662. George Edward Dering.
2795. John Horsley.
2797. John Henry Johnson.
2886. Louis Rudolph Bodmer.
2910. Frederic Holdway.
288. John O'Meara Beamish.
312. Francis Montgomery Jennings.

Sealed April 8th, 1856.
2266. Thomas Oddie, William Lancaster, and John Lancaster.
2274. William Bayley and John Quarmby.
2306. Enrico Angelo Ludovico Negretti and Joseph Warren Zambra.
2308. George Thomson.
114. William Prangley.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID

April 1st.
872. Richard Archibald Brooman.

April 2nd.
801. William Walker.
1020. James Andrew Bruce.

April 3rd.
804. Charles May.
826. Henry Alfred Jowett.
839. Robert Pattison Clark.

April 4th.
842. Christopher Nickels.
889. François Félix Verdié.

April 5th.
852. George Herbert.
853. Joshua Farrar.
887. George Elliot and William Russell.

(*Omitted from Journal of 28th December*, 1855.)
December 20th, 1855.
1161. George Bower.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3824	April 3.	Frame or Stand of a Mill……… …………	Ransomes and Sims ………	Ipswich.
3825	April 8.	The "Carlisle" Morning Coat …………	Edward Smith and Sons Joseph Smith and Sons	Leeds.

Journal of the Society of Arts.

FRIDAY, APRIL 18, 1856.

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EIGHTEENTH ORDINARY MEETING,

Wednesday, April, 16, 1856.

The Eighteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 16th inst., Colonel W. H. Sykes, F.R.S., in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Babington, Charles Metcalfe, M.D.
Cartwright, Samuel
Hyett, W. H.
Kenworthy, James Lees
Ransford, Henry
Wheen, Richard
Wolrige, J. C.

The paper read was—

ON THREAD OR FIBRE GILDING.

By Francis Bennoch.

When I consented to introduce the subject we are assembled this evening to discuss, I had resolved to confine my observations within the narrow limits of certain recent discoveries, in which I had become interested, but I soon found that, however interesting a paper so limited might be in itself, it would necessarily leave untouched the large and important subject of fibre plating, or covering threads of silk or cotton with gold or silver, so that the precious metals may be used with facility in the manufacture of gold and silver tissues. To clearly understand the several processes required for the production of such fabrics, it became necessary that I should refer to other and apparently distinct branches of industry, such as silver gilding and wire drawing. I therefore resolved to investigate the general subject as deeply as my time would allow, and bring the result of my inquiries within the space of a single address, in which I shall endeavour to describe, as clearly and simply as I can,—

1. The high favour in which such fabrics have been held from time immemorial;
2. The ancient system of manufacture;
3. The system prevailing in the present day, and
4. The new principle of fibre gilding.

I shall not occupy your time with any lengthened or unnecessary reference to its antiquity, because the facts are sufficiently known to all students of profane or sacred history. It is, nevertheless, desirable that some brief reference should be made to the past; my object being to bring together all the important facts, whether ancient or modern, that I have found to bear upon the subject.

The history of ornamental jewellery from the earliest times—the purposes it has served—how and why rings and chains and bracelets, and wreaths and crowns, became and continue indispensable ornaments, would form an instructive paper, and may be taken up by some member connected with that special business; my duty being to confine my remarks to the production of threads used in the manufacture of woven or embroidered fabrics.

Innumerable references are made in the sacred writings to the liberal use of gold and silver, not only for personal adornment, but also for the highest ceremonial purposes.

In the Old Testament we are told (Jer., chap. x., v. 9th) "Silver spread in plates was brought from Tarshish, and Gold from Uphaz, the work of the workmen and of the hands of the founder. Blue and purple is their clothing, they are all the work of cunning men." It is evident from this and other passages that fire was used in purifying the metal; that it was afterwards founded or cast into certain forms, preparatory to its being beaten or hammered, and fitted for the purposes for which it was intended.

I would here remark that, although gold may not now-a-days come from Uphaz or silver from Tarshish, still there is ample evidence in the Scriptures to prove that the precious metals were found in great abundance in those early ages of the world. I would, therefore, humbly suggest the propriety of exploring those regions, for, whenever metal is found in considerable quantities isolated or detached, we may safely conclude that not far removed may be found the same metal in greater masses. The enterprise of the present day scarcely needs a hint, and I merely give utterance to the opinion, that, with our boundless power, untiring energy, and great skill in mining, immense quantities of gold may be discovered in those old and comparatively neglected countries.

The first important use made of gold was in the construction of the Ark of the Covenant, and Bezaleel, the son of Uri, the son of Hur, of the tribe of Judah, is described (Ex. xxxi. verses 2, 3, 4) as specially called, and by inspiration "possessed of all wisdom, understanding, and knowledge in all manner of workmanship, and to devise cunning works in gold, and in silver, and in brass, and in cutting of stones to set them." Then (in the same chapter, v. 38) the *ark* is described as being "overlaid with pure gold within and without."

So in the building of the Temple (1 Kings, chapter vi. verses 21 and 22), "Solomon overlaid the house within with pure gold, and he made a partition of gold before the oracle, and he overlaid it with gold, and he overlaid the whole house with gold, until he had finished all the house, and also the whole altar that was by the oracle he overlaid with gold."

It is interesting and very suggestive to observe, that, wherever the highest and holiest thoughts and purest motives ought to have existed, and where the objects were of the most sacred nature, the purest of all metals was enjoined to be used, and doubtless intended to symbolize the purity of the purposes to which it was applied.

The functions of the priest were the loftiest and purest, and the temple in which he served was designed to last for ever; therefore, the purest metal was adopted as indicative of the purity and endurance of the priesthood and the temple.

After the construction of the ark and the tabernacle we have a description of the garments of the priests (Ex. xxxix. ver. 3)—"And they did beat gold into thin plates, and cut it into wires to work it in the blue, and in the purple, and in the scarlet, and in the fine linen, with cunning work."

As we are not told what breadth the plates were, it would be idle to speculate on the length of the wires. I apprehend, however, that the wires here referred to should not be understood to mean what the word now implies. When we remember the marvellous particularity with which the minutest details in reference to the building of the temple, the tabernacle, the ark, and the woof of the priestly raiment are described, I am persuaded that had the gold been *drawn* into lengthened wires the particulars of the process would have been given. In the absence of such information, and taking the facts as they lie before us, I arrive at the conclusion that the wire mentioned was only narrow shreds of thin gold, which, in all probability, did not exceed the width of the web from which the garments were to be made, and these webs need not have been more than a few inches wide. We shall, by and by, see that even now in the East certain robes are made of narrow stripes, and the fashion may have been handed down from the time of the patriarchs.

From specimens shewn it will be seen that having succeeded in producing a wire of great length, it is used longitudinally as a warp, thus avoiding the difficulty experienced where the wire thread is passed from side to side, as in the weft or shoot.

So also in covering the sacred places within and without with pure gold, we are not informed how the plates were fastened. We very naturally, and I think truthfully believe, that they were rivetted, or fastened with nails, and probably, as regards the mere workmanship, were exceedingly rude; at all events, we are justified in the opinion that had other means been employed they would have been fully described. This view is partly confirmed by the fact that the words "gilt" or "gilding" do not appear in the sacred writings. So far as I am aware, we have no precise data from which we can determine the period when gold was first attached by an adhesive medium; but, for our present object, such a fact is comparatively unimportant.

Although the system adopted in the East, and prevailing there at the present moment, may greatly differ from that which existed in the days of Moses, still in my judgment there must be some similarity. By ascertaining the method now pursued in India, I believe we shall get a glimpse at the plan adopted by the earliest workers in the precious metals.

While I was pursuing my inquiries into this branch of my subject, there appeared, most opportunely, in the *Illustrated London News* of Nov. 10, 1855, a lucid and concise account of the process referred to, which, with gratitude to the writer, and thanks to the proprietor of the *Illustrated News*, whose permission I have to use it in this paper, I will give the details pretty nearly *verbatim*. The communication is dated Ahmednugger, and is signed "B. B."

The city of Paithun, situated on the river Godavery, is famed for its manufactures in gold and silver tissues, viz., pugrees or turbans, doputtas or long shawls, and sarees or women's robes. The highest qualities of these several productions are sent to the courts of Gwalior, Baroda, and Hyderabad.

The long shawls which are thrown over the shoulders of the native princes on all occasions of state ceremonial, frequently cost as much as 3,000 rupees (£300) each. The weft is composed of very fine cotton-thread, generally scarlet or green, the warp being of silk of a similar colour. The shawls are sometimes in long stripes of about an inch in width, and placed alternately a stripe of scarlet and a stripe of gold. The ends are of cloth of gold, about a yard in depth, and the whole shawl is surrounded by a rich border of flowers or birds in variegated silks, woven on a gold ground. Some of the sarees are made of thick shot silk in narrow stripes, and finished in a similar manner; while others of the same texture, as the doputtas, are flowered, spotted, or striped with gold, and are about nine yards in length. They present a most gorgeous appearance being in texture like the fine muslin gauze of ladies' dresses, and it is by no means uncommon to have them of the value of 225 rupees (or £22 10s.) each.

Dr. Royle, in his instructive lecture* on "The Arts and Manufactures of India," informs us that, "among the references to silk in ancient authors, there is also frequently mention made of gold and silver as interwoven with silk; even the Coan women are represented as interweaving gold thread in their silken webs, and Caligula as wearing 'a tunic interwoven with gold.' Babylonicum was the name applied to the splendid productions of the Babylonian looms. These are described as being adorned both with gold and with variously coloured figures. A peacock's train is compared to a figured Babylonicum, enriched with gold; while Peplum, the shawl, had the greatest skill and labour bestowed on its fabrication, and various objects were frequently represented on it; that worn by the Pastophori in religious ceremonies was richly interwoven with gold, and displayed various symbolical and mythological figures; while the Paragauda—a word supposed to be of Oriental origin—we learn was the border of a tunic enriched with gold thread, and worn by ladies. There is no doubt that it has long been the custom so to adorn garments in the East, and we have had numerous such specimens sent to the Exhibition."

Such are the fabrics indispensible to the dignity of Indian princes, specimens of which, by the favour of Colonel Sykes, chairman of the East India Company, I am able to exhibit for the instruction of my audience.

We must now turn to the process employed in the manufacture of the gold thread which forms the basis of these truly magnificent fabrics, and which is more german to the purpose of my address than the fabrics themselves.

A rod of silver, weighing about 22 rupees, or about 8oz., after having been roughened by a file, is covered with a leaf of the best gold, weighing one rupee, so that gold forms one-twenty-third part of the whole metal. The method adopted to make the gold adhere to the silver is very simple. The rod of silver having been wetted, the gold leaf is laid on, and pressed with the fingers, and afterwards rubbed smartly on the thigh. The small portion of gold that may overlap hangs loose, and is cut off; the edges of the gold leaf that come in contact are beaten a little thinner than the body of the leaf, so as to secure, as nearly as possible, an uniform thickness.

The bar so prepared is heated in a pan of charcoal till it becomes red-hot. It is then taken out and hammered, and rubbed with a piece of wood, and is ready to undergo the first process of being drawn into wire. The rod is, at this time, about the thickness of a man's thumb, and from six to eight inches in length. In the wiredrawer's house there is a pit dug in the floor, about thirty inches deep, containing a rude horizontal wooden cylinder, or beam, turning on pivots fixed into each end, placed in sockets at the side or end of the pit. In this cylinder are fixed four handspikes, over one of which is slipped a ring, to which is attached a chain, with a ring at the other end. Through this ring is slipped the head of a pair of pincers, in the jaws of which is placed the end of the gilt bar, which had previously been hammered at one end, so as to enable it to pass through the hole pierced in a steel plate, through which the bar has to be drawn, and, being drawn, is reduced in diameter, and proportionably increased in length. The handles of the pincers being considerably wider than the head, and the ring gripping both handles, it follows that the greater the strain on the handles, the closer the grip of the jaws. The hold is tightened by placing a small piece of mica between the rod and the jaws of the pincers. One man holds the rod steadily and straight to the die, while another man turns the cylinder by pulling with his hands, and pressing with his feet, the handspikes, in the same way as we occasionally see the steersman at the wheel of the rudder of a large ship. As the cylinder revolves, the rod of metal lengthens, and winds round the cylinder. To lessen the friction in passing through the holes, the rod is invariably rubbed over with wax.

Having passed through the holes in the steel plate, each hole being a degree finer than the other, the wire is coiled up and reheated, or annealed, by which it is softened, or made more malleable. Were this precaution omitted, the wire would become brittle and break like cast metal. This process of drawing and heating is repeated over and over again, until the wire is reduced to the substance of ordinary whip cord, and it then passes into other hands. The importance of the division of labour is here recognised. The hands best adapted for the heaviest processes are altogether unfit for the more delicate branches of the business.

The workmen into whose hands the wire is now placed sit at a small bench, on which are two reels or large bobbins a short distance apart, on one of which the wire is wound; midway between them is fixed edgeways a frame, with a steel plate pierced with fifteen or twenty holes of different degrees of fineness. To make the wire pass easily through the finer hole, it is rubbed at the end between two pieces of porcelain, then slipped through the hole—caught with a pair of nippers, and attached to a limb or spoke of the empty reel, which is turned by the hand, and the wire is driven through with perfect ease. This operation is continued and repeated until the wire becomes as fine as the finest hair.

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* See Lectures on the Results of the Great Exhibition of 1851; delivered before the Society of Arts. 2 vols., 8vo. Bogue. London, 1852-3.

In this state it cannot be used, for it is too weak to be woven, and must be united with some other fibre before it can be worked in the loom; and being round, it will not readily attach itself to the thread. It therefore becomes necessary that it should be flattened, which is done by beating it with a highly-polished steel hammer, on an anvil equally well polished, as the least flaw would damage the wire.

Eight or ten threads are wound on as many several small reels, like cotton spools. These are placed in two rows, on pegs fastened to a board, so as to turn horizontally. The several ends are passed through a row of small holes pierced in a piece of thick fish skin attached to the anvil with wax—the holes being level with the surface of the anvil.

By these means the gold wires pass on to the anvil separately, yet near each other. The operator seizes all the threads with the left hand, and draws them gently across the anvil, while with the right hand he hammers them as they pass. With one stroke he flattens the eight or ten wires, and with such remarkable skill that scarcely any difference can be detected in the width of the flattened wire, so accurately has each blow been given.

The flattened wire now passes into the hands of a spinner or plater of gold thread. The process is very interesting. The orange coloured silk is wound round two spindles, such as are used for spinning cotton or wool—the ends of the two threads are passed through a ring fastened to the ceiling of the room, and both bobbins are brought to an equal height from the ground; by being rubbed sharply along the thigh they are set in motion in opposite directions, and spin round with great velocity. As they spin, the gilt wire, flattened as described, and guided by the left hand, is wound round the threads with an evenness and regularity almost incredible, considering the rudeness of the implements used; and our surprise is greatly increased on examining the articles afterwards manufactured.

"B. B." concludes with expressing the belief that few (probably no) improvements have been made in the system since the manufacture first began, and he informs us that the greater portion of the inhabitants of Paithun are engaged in the different branches of this manufacture.

In this very concise description of a most interesting branch of industry there are several facts of detail omitted which it would have been well to have had supplied, such as the time occupied in bringing the rod of six inches long into the wire as fine as a hair—the length of the hair so drawn—the value of the labour so condensed, and sundry other points without which we cannot satisfactorily arrive at any economical result. These omissions, however, are amply supplied by the processes adopted in London, and I believe the same or very similar methods prevail in the several cities of Europe where the manufacture of gold lace is encouraged, but I shall confine myself to what I have seen, and in this branch of my paper I am much indebted to the courtesy of Messrs. Johnson, Simpson, and Simons, whose works have been thrown open to me, and to Mr. Simons I am indebted for many of the details I now proceed to give.

Silver being the basis of what is techically called gold thread, it is well to consider what silver is best for the purpose. In this, as in every other metal, there are certain kinds possessing qualities very superior to others. Some are characterised by great tenacity or toughness, suitable for all purposes where that quality is a proved essential. Others are harder, less pliable, and more susceptible of fracture by a sudden concussion, a slight blow being sufficient to break them. The silver in greatest favour with wire-drawers is extracted from lead. This may probably retain a certain portion of the nature of the ore with which it was previously in combination, and may be tougher than that obtained from other mines. The manner in which the silver is separated from the lead is very simple and most interesting. Without detailing the several processes practised by various miners, I need only refer to an improved plan I saw in operation at the lead mines of the Duke of Buccleuch, at Wanlockhead, in the high district of Dumfriesshire. The process is founded on the property which bodies possess of separating from each other during crystallization. The argentiferous lead is melted in a large vessel, and the temperature is arranged to such a point, that the lead becomes crystallized. The crystals of pure lead are then removed as soon as formed, by means of a large iron ladle, pierced with holes, and the silver is thus left combined with a smaller portion of lead, which thus gradually becomes more and more rich, until, by successive operations, it is brought to such a state, that further separation can be advantageously effected by the ordinary means of cupellation.

The facility with which silver can thus be separated from the lead, gives the owner the advantage of making the lead of the required richness. I need hardly tell this audience, that the quality of lead depends greatly on the quantity of silver combined with its The silver so produced, comes to the market usually in the form of a cake, which I now show you, and is afterwards melted and grained, like this other specimen, in a glass. A certain quantity is weighed—say from 400 to 500 oz.—and placed in a crucible, or, in the common language of the trade, a pot, which is placed in a charcoal fire, and there remains until the metal it contains is of nearly a white heat. The best crucibles for such purposes are, I am informed, of American manufacture, and composed of black lead and a mixture of a peculiar clay. When heated as described, it is ready to be poured into the ingot mould. These moulds are made of iron, and sometimes of copper; but it has been proved by experience that the iron mould is the better of the two. The copper moulds, after being used a given number of times, are liable to fracture. Before pouring the metal into the mould, it is important that the mould itself should be heated to a certain point. Unless this is attended to, steam or gas is generated, and causes a spurting of the metal, producing air-bubbles, or flaws, in the ingot, and any imperfection of that nature produces an ultimate defect in the wire drawn from it. The ingot mould is in two pieces, kept together by very strong clamps and screws, and when the metal is sufficiently set, the screws are loosened, the mould separates, and the ingot of silver falls easily out., The ingot so cast is about 2 inches in diameter, and from 20 to 24 inches in length. The bar, or ingot, is then placed in a charcoal fire until red-hot, whence it is taken and held and turned on the anvil by one man, while three others, with heavy hammers, hammer it well. This beating and hammering continues until the bar is reduced to a size suitable for the first hole or die through which it has to be drawn, and by the hammering is increased in length from 4 to 5 inches, or about 20 per cent. The hammering, so fiercely applied, changes the nature of the metal precisely in the same way as iron is changed by rolling and hammering, laying all the fibres one way, and proportionably increasing its tenacity and elasticity. The bar so prepared is pointed, and made to fit the first die through which it has to pass, and laid on the draw-bench with the point slipped through the die. The point is then seized by the jaws of a pair of monster pincers or draw tongues, with short bow arms, at the end of each of which is a hook that slips over a ring attached to the end of a strong chain cable, drawn by a steam-engine exerting the power of 16 horses. The greater the draught the tighter the grip, and the ingot passes through the first die with the greatest ease, and is reduced in diameter, but increased in length from 10 to 15 per cent. This process is repeated ten or twelve times, each time the rod being drawn through a smaller die. The bar is then removed to another bench, where it is planed so as to remove all roughness or other imperfections on the surface, as the slightest blemish would interfere with perfect gilding, such blemishes being best detected by placing over the bar a sheet of foolscap paper, slightly arched, which by its reflection, shows every speck instantly and most distinctly. The bar of metal, being so prepared, is considerably reduced in weight as well as in size, and is now ready for gilding. As the richness of the wire depends upon the thickness of the gold laid on, and as all the gold leaves are very nearly, if not absolutely, of the same substance, the quality of the wire is regulated by the number of leaves placed one over the other, and these vary from 10 to 30 leaves. The higher qualities are used for military purposes, and pearls and bullions for embroidery. The lower qualities being in demand chiefly for liveries, for the ends of muslins, and also for skein threads exported to India and China. The gold leaves, whether of the depth of 10 or 30, are laid in a row side by side, nearly the length of the bar, on a piece of ordinary cartridge paper; the bar is gently laid on the leaves, pressed close, and the edges of the leaves raised up until the silver is entirely covered with gold leaf; there is no size or foreign matter whatever used; because any such matter would, in the fire, prevent perfect cohesion. Nor is there any water used, as in the Indian process, the natural affinity of the highly polished silver to the gold appears to be sufficient The bar so overspread with leaf, is enveloped in paper and tied tightly round with ley cord and placed in the centre of a heap of lighted charcoal, where it remains until it assumes a bright red heat. One would imagine that the paper must instantly take fire and disappear, but such is not the case. The atmosphere being carefully excluded, it gradually becomes red with the metal, and when the paper has been entirely consumed, the bar is nearly ready to be withdrawn. While red-hot, it is placed on a frame or bench, and vigorously burnished with a blood-stone—a substitute for which, and nearly as good, has been found in a stone discovered in the South Seas, probably the same as that from which the natives of those islands make their spear-heads, hatchets, and weapons of war. This burnishing serves a double purpose; it forces out any air that may have remained between the gold and the silver, and at the same time brings them closer together. When quite smooth, it is permitted to cool gradually.

When quite cool, the surface is covered with wax, and then commences the more rapid reduction of size by drawing the bar through graduated steel dies, highly-polished, as the slightest roughness would damage the metal, and although it might now pass undiscovered, by and by it would show itself in defective wire; so that these slight physical defects, like moral flaws, cannot be always hid, but, sooner or later, will appear on the surface. When reduced to this size, technically called disgrossed, it is annealed, care being taken to exclude the air from the surface, otherwise the gold being now so thin on the silver would partially melt, and present a blackened appearance. After remaining in the fire about an hour, it is placed under other superintendence, and removed to other machinery, moving with greater speed, and rapidly passes through a number of finer holes, each decreasing in size until it is reduced to the size I hold in my hand. After which it is heated and drawn through a hole, which removes all wax and dirt from the surface.

The steel dies are then dispensed with, because, from experience, it was found that the holes were liable to become what wire drawers call square; and until within a comparatively recent period the ounce of metal could not be drawn into more than 900 or 1,000 yards.

One of the firm to which I am so much indebted was, I believe, the first to suggest an experiment with a jewelled die. They experienced many difficulties at first; but all were overcome, and a perforated ruby, set in a metallic frame, such as I now show, answered admirably, and enabled the drawer to produce, from one ounce of metal, a wire a mile and a quarter long—a specimen of which I have here, and you will observe that it is finer than a lady's hair. In connection with this discovery, it is somewhat singular that there are not more than three men in London capable of perforating and setting these ruby dies properly; and one man, who works probably not more than three hours a day on the average, has received from one wire-drawing firm as much as £500 or £600 in a single year, while they only pay from 4s. to 5s. for each die.

All the wire is not made so fine as the sample just shown, as the size depends upon the purpose to which it has to be applied. Presuming that the finest point is reached, it is found that the colour is not so rich and deep a shade of yellow as fashion desires.

To effect this a very simple and ingenious plan is adopted. The wire is wound round a copper cylinder, a small portion of wax being added. The bore or cavity of the cylinder is filled with red hot charcoal, made from birch wood, that being found the best; so the wire in its finest state is again annealed; and what appears singular, the colour is deepened and rendered permanent.

So great is the tenacity of even the finest size, that a piece of wire 12 inches long will bear 12 ounces in weight. It is now ready to be flattened preparatory to spinning round the silk, and this is accomplished by winding it from the copper cylinder on to smaller bobbins, ready for the flatting-machine, which is very simple and very small. There are only two rollers for it to pass between, the one being about 10, and the other 4 inches in diameter, and 2 inches wide, slightly convex on the face.

To impress a substance as fine as a hair, and flatten it to twice or treble its original width, requires the nicest possible adaptation of parts. You will not be surprised to hear that a single pair of rolls costs £120. The metal is of the rarest quality of steel, and the polish higher than the finest glass. At one time these rollers were made in Sheffield, but now they are manufactured in Rhenish Prussia.

The wire so flattened is now wound on small bobbins, which are placed in the centre of circular rings, attached to a bar over a spinning frame. On the front of the frame, are bobbins of silk, the threads of which pass through the centre of the ring to which the reel with wire is fixed. The whole is set in motion, and while the thread is being twisted, the ring with the wire revolves round the thread in the opposite direction, and 30 or 40 threads are plated at once—one girl attending to them all—and so the gold thread is finished and ready for any purpose the consumer may require.

In its new form, though only gold is seen, probably nine-tenths of its bulk is silk, while of the remaining one-tenth, only one-fiftieth part is gold—so by labour and ingenuity we are put in possession of a gold thread—of which only one part in five hundred is, in reality, gold.

Let us glance only for a moment at the labour required to reduce the ingot of silver, weighing 420 ounces, to the finished wire, weighing 360 ounces, 60 ounces having been cut off—not destroyed—in the several processes of pointing, planing, and occasional accidental waste:—

	Hours.
To reduce the ingot to the size when it is cut into 10 equal parts, of about 36 ounces each, takes 3 men 20 hours each	60
To reduce from hank to firing off size takes, for each hank, 1 man 5 hours, or for 10 hanks ...	50
To reduce from firing off to 300 yard per ounce size takes, for each hank, 9 hours, or for 10 hanks.	90
To reduce 300 yards to 1,200 yards per ounce size takes, for each hank, 18 hours, or for 10 hanks	180
To reduce from 1,200 yards to 1,800 yards size takes, for each hank, 25 hours, or for 10 hanks	250
If reduced to 2,000 yards, each hank would take at least 7 hours, or for 10 hanks	70
	700

Allowing 10 hours to the day, it would take one man 70 days or 10 weeks to reduce by his labour the ingot of silver, weighing 420 ounces to its finest size. But no one man is equal to the entire duty. The early processes demand the exercise of Titanic powers, while the later processes demand the lightest touch of almost fairy fingers.

In constructing the foregoing table, I have had some difficulty, from the fact that, so far as I can discover, the question has never before been looked at from the labour-consumption point of view. There may be some errors, arising from imperfect information, but I believe it will be found sufficiently accurate to enable us to estimate the labour required to make 400 ounces of gold, in a bar 20 inches long, stretch over 500 miles, and 50 such bars would bind the earth with a golden hoop. But as the 400 ounces of silver is gilt with only eight ounces of gold leaf, each leaf weighing 18 grains, and 4 inches square, it follows that only one-fiftieth part of the wire is gold. So eight ounces of gold in combination with silver is made to stretch 500 miles, or over 60 miles for a single ounce. Nothing can more clearly show the wonderful ductility of this most wonderful metal. One would imagine that in passing through so many holes, the gold would be liable to be scraped from the surface of the silver, but it is not so. In passing through the die every atom of the metal is excited and stretched simultaneously, each atom retaining its relative position. As, from first to last, the wire passes through 100 to 120 dies, it follows that the ingot in its course traverses over 50,000 miles, or twice the circumference of the globe.

Before passing to the last division of this paper, a few observations may be permitted, marking the differences that exist between manual and mechanical labour, as suggested by the Indian and English processes of wire drawing.

In London, I believe that 500 ounces of metal could be drawn into wire while 10 are drawn at Paithun.

In London, it can be drawn 2,000 or even 2,200 yards to the ounce, while in Paithun they stop short of 1,000 or 1,200 yards.

In London, the manufacturer depends upon mechanical ingenuity, which enables comparative children to execute a very large proportion of the work, while in India age and great experience are essential to the production of a marketable commodity.

The difference, in my judgment, will increase year by year. Electro-gilding in some way or other must, sooner or later, supersede the present process. Whether its application shall be to the bar of silver in bulk, or to the completed wire, I am not sufficiently skilled in chemistry, nor sufficiently acquainted with wire-drawing, to determine; but looking at the conditions of the trade, and considering the scientific principles involved and the chemical processes that may be applied, I have no more doubt of the result desired being accomplished than I have in my own existence.

Certain it is, that ere long, English industry will supply India, and probably China, with all the prepared thread they require for the production of their sumptuous robes; my only surprise is, that English enterprise and English looms have not long ago supplied those distant countries with the manufactured article.

When we consider the consumption of the precious metals—the no less precious money, and the still more precious labour consumed in the manufacture of gold thread, it is not only not satisfactory, but very humiliating, to confess that a very large proportion of the quantity produced is flung away and wasted, much being consumed in bars of gold shot in at the ends of webs of muslin or other cloth, to produce an attractive finish, which, when purchased for consumption, is torn off and cast into the fire.

Having entered so fully into the details of wire drawing, flatting, and spinning, I imagine that my audience will now, by analogy, more closely apprehend the various principles and processes bound up in the new and patented plan of

Fibre Gilding.

For many years chemists have attempted every known method of gilding, in the hope of discovering some process by which silk, or other fibre, could be gilded without applying the immense labour, seen to be necessary, before a thread with a covering of gold can be used with facility in the loom, and woven into cloth—but they always failed. In France, where scientific research is liberally promoted by the Government, a large reward was offered for a successful plan, but no man ever had the opportunity, or satisfaction of claiming it. The electro process gave a fresh impulse to scientific men.

The difficulties of the first stage were soon overcome, and gold was compelled to attach itself to the surface of the thread. Here a new difficulty arose—the thread, being completely soaked, was long in drying, and when dried, had lost its lustre; while the foundation on which the gold rested was so soft and flimsy, that to burnish it was impossible. They only produced a gold thread which had not the effect of gold, and was therefore useless. Among the several investigators was Mr. Albert Hock, who, failing to find in chemistry the principle by which fibres could be gilded, succeeded by means of a simple mechanical contrivance.

I have more than ever felt to-night how difficult it is to find words calculated to explain the simplest mechanical movement, and now the difficulty is increased a hundred-fold. I intended to have constructed a small model machine, but that I found utterly impracticable in the time I had given myself to collect facts and prepare this paper; I must, therefore, endeavour to make words supply the place of a machine, and if I fail in making you understand the method, I shall, through your eyes, convince you that the work has been done, by exhibiting shawls, and other specimens of manufacture, from material so produced. In the first place, it is essential that the silk used should be of a superior quality, free from knotty nibs and rough places. The gum must be boiled out of the silk, and then the silk tinged to the shade of a light orange, of which I show you a sample; it is then wound on bobbins, as you see—the bobbins are placed on a wire, on which they revolve when gently pulled. The end of the thread is is passed over a wire, and then under a roller, which works in a trough containing a glutinous but transparent liquid. It then passes over a reel attached to an endless screw or threaded spindle, so arranged that it lays on a brass cylinder the thread of silk as close as cords are wound round the handle of a whip, without overlapping, until the cylinder is completely covered with the silk, when the thread is broken; the length of the skein of thread depends, therefore, upon the size of the cylinder and the fineness of the thread, but the cylinder cannot be increased beyond a certain size, and that size must not be larger than can be spanned by a single leaf of gold, and the gold-beaters will not produce it larger than 3⅘ths of an inch square. When we required the leaf to be beaten 4 inches square, the gold-beater declined the order, advancing as a reason, that, were he to demand such a size, every journeyman he had would strike and leave him. So we had to get the gold leaf from France, another instance of the mischief done to commerce by trade combinations.

The cylinder being covered with silk in a gummy state, the book with the gold leaf is opened and laid on the palm of the hand; the machine—something like a turning lathe—is moved; the edge of the leaf is made to touch the gummed silk, and it is quickly drawn round the cylinder covering the silk. This is repeated until the entire surface of the roller is covered with gold leaf. A piece of cloth or washed leather is fastened on a slip of wood, something like a razor-strop. The roller is turned round and the strop pressed firmly upon the leaf, which not only presses the leaf closer to the silk, but separates the leaf between each of the windings of the finest thread. Thus one side of the finest thread is gilded. It is thus apparent that if gold and green, or any other colour, is desired in combination with gold, we have only, first, to dye the thread the colour we require, and then, by gilding one side, we secure the combination wished. To gild the entire thread we have only to wind the half-gilded thread on to another roller. The gilded side of the silk thread necessarily winds next to the brass on the second roller, leaving the un-gilt part of the thread exposed, and ready to be treated in the same manner as before described, and so the process is completed. It is then wound on to reels of the usual size, and permitted to dry thoroughly. After this it is reeled on boards, or, as the French call them, planchettes, in the manner of the samples exhibited, and is ready for the market. The colour, you will observe, is very beautiful, being the natural colour of the gold leaf. The great advantage of this over every other thread is its lightness and perfect flexibility, for it can be wound and woven wherever any other thread can be wound or woven. Its only disadvantage consists in the impossibility of producing by this process, that tinselled and glaring effect which ladies seem to consider a prime essential wherever gold is used. In reality it is a new but very expensive colour. The sizes of the threads are regulated by the number of ends of silk wound round the roller at once. The substance used for attaching the gold leaf to the threads, unites them at the same time, and brings them into one thread.

Thus No. 2 means two threads, No. 3 three threads, gilded together.

As regards cost it is, size for size, considerably dearer than the ordinary gold thread, but as it measures a much greater length for the weight, it virtually becomes, for weaving purposes, very much cheaper. The finest ordinary gold thread measures about 550 yards to the ounce, and costs about 8s. A similar size of gilded silk, weighing one-third the weight, and measuring the same, would not cost over 5s. Where fine gold leaf is used it is untarnishable, but copper can be used with the same facility as gold, and comes at little more than half the price, while for ordinary purposes it answers quite as well. The shawls I shall exhibit are made from fine gold. The gauze scarfs are made from copper, and the difference can scarcely be detected.

In France there is a considerable demand for, and a steadily increasing consumption of, the material. Whether the manufacturers of England will enter the lists, and endeavour to compete with their enterprising neighbours, is more that I can tell. I only know that the patentees, after spending large sums in perfecting the principle, have so far received less encouragement than they had a right to expect from the manufacturers of the United Kingdom.

There is one advantage in fabrics composed of this gilded silk, which cannot fail to be appreciated hereafter, and that is, their exceeding lightness when compared with productions from the old class of material; and you will observe that, as respects brilliancy, there is little, if any, difference. Wherever fine gold is used it will never tarnish.

My task is done. I have as concisely as possible brought together all the facts relating to the several processes of plating and gilding fibres. In pursuing my inquiries, I could not but remark the immense labour and patient industry devoted solely to the indulgence of luxurious tastes. This idea will, doubtless have flitted across the minds of many of my audience; nor do I lament and bewail, as some do, the amount of money expended in gratifying those desires. To confine one's attention to the mere necessaries and utilities of life would be to rob existence of many of its loftiest pleasures. The subject to which our attention has been directed this evening cannot be considered as partaking of the high qualities referred to, still, it is novel as well as interesting,—and although I can hardly expect the information derived will fully compensate for the time expended, I, nevertheless, hope you will not consider the time we have been together as an hour altogether wasted.

DISCUSSION.

Dr. Forbes Royle, F.R.S. said, the first expression was one of admiration of the beautiful invention of Mr. Bennoch, and the very admirable way in which it had been adapted to the old manufactures of the East. He would confine his observations to the Indian fabrics, to which alone he had paid attention. In the first place one could not but be struck, the more the inventions and the manufactures of the natives of the East were investigated, with admiration at the ingenuity with which they discovered, at very early periods of the civilisation of the world, those different modes of fabrication. Although machinery here had carried these out to a marvellous extent, the principles of these Indian manufacturers had been adopted. There could be no doubt that gold had been used for these purposes in the East from the earliest ages, as was evident from the Rig Veda. Wire drawing, as was apparent from what they had seen and heard that evening, could have been discovered only in a country where steel was also known. In India steel was known at very early periods. In Persia, the nearest country to it, which was early civilised, they had a proverb, in which, "to give an Indian's answer," meant "a cut with a sword made of Indian steel. This alone would prove the early period at which Indian steel was known in the countries of the East; the Damascus blades were considered to have been made of the same material. Mr. Bennoch had referred to an article lately published in the *Illustrated London News*, but he would find in the catalogue of the Exhibition of 1851, a description of the drawing of this gilt wire, nearly as minute as that given in the publication referred to, without, however, the advantages of the illustrations, which gave so good an idea of the simple methods by which the natives of the East attained the same ends as were effected in this country by means of complicated machinery. The Indians, at Boorhampore, washed both their gold and silver with lime juice and water, in order to give them a perfectly clean surface before they brought them into contact with each other. There could be no doubt that the discovery of this wire-drawing was due to the natives of India, although Beckman, in his "History of Inventions," ascribed it to the Germans of Nuremberg. But if we looked to the mode of drawing gold and silver wire, as practised in India, and the curious way in which the last link of the chain was made to lay hold of the handles of the pincers, as well as the necessity of having good steel dies or plates, all the same as had long existed in, and was now practised in, many parts of India, there could be little doubt of its being the original country of the invention, especially as it was not known till the fourteenth century in Europe, when so many Europeans travelled to the East. With regard to what Mr. Bennoch had said about some of the specimens before them being the products of Europe, it was difficult to determine that question in all cases. He could only say if the flattened gilt wires were of European make, the manufacturer had been ingenious enough to tie up the skeins with Indian cotton. He (Dr. Royle) thought, notwithstanding the regularity of the fabrics, they were all of Indian produce. If they examined the skill with which the silk thread was covered with the gold, nothing was more astonishing than the great regularity with which this was done, although it was effected in the way described, that is, by covering the silk while it was twirling round, by merely holding the flattened wire in the hand. But an Indian sage had described the human hand as the best of all instruments. Sometimes, with the view of deadening the lustre, and producing the softened effect so much admired in Eastern productions, the thread was only partially wound with the gilded or the silver wire. The committees of India for the Great Exhibition were directed to send only the productions of their own districts. Hence some long pieces of magnificent gold lace, of different patterns, were sent from Agra, where it was extensively manufactured for the army. He repeated his opinion, that the great majority of the specimens before them were Indian productions. The skill with which the silk was gilded was of great use in weaving gold into their rich fabrics. In the gorgeous specimens before them (alluding to the robes exhibited, the property of the East India Company) they had specimens both of the flattened wire and of silk covered both with silver and with gilt wire. The softened effect of one part was produced by the covered silk with fine wire, and contrasted well with the other parts in which the glistening effect of the flattened metal alone was obtained. The only other observation he would make was, that notwithstanding the ingenuity of Mr. Bennoch in gilding fibres, the natives of India had come extremely near the invention in gilding cotton, as was evinced in the specimens of gold printing upon calico and muslin which he produced, and which were very beautiful. The fibres were perfectly flexible, and sustained no injury from being crumpled up. This was a process which was carried on in many parts of India, where there was a sufficient amount of population to create a demand for such articles; and it was another instance of the ingenuity with which they had discovered so many of these manufactures. He had no doubt they would be able to make use of Mr. Bennoch's gilded thread, which would suit many of their fabrics, especially as they had not to import the taste to work them up into harmonious designs.

The Chairman, in offering his acknowledgments, and he was sure those of the Society of Arts, to Mr. Bennoch for his elaborate and lucid explanation of the modes of preparing gold or silver threads or fibres and their employment in woven fabrics, would take advantage of Mr. Bennoch's concluding observations, on the apparently small interest manifested by the manufacturers of England in such products, to state that the existing commercial relations between England and India were such as to demand the most active ingenuity on the part of the manufacturers of England to produce marketable goods of a new character for India, with a view to lessen the perennial drain from England of the precious metals, to adjust the annual balance of trade in favour of India. The facts were, that the export trade from England to India would seem to have attained its maximum for the last three or four years; while the export trade from India was gradually and steadily increasing, leaving a yearly increasing balance of trade in favour of India. Comparing two periods of the trade of India, 1834 to 1835, to 1841 to 1842 inclusive; with 1849 to 1850, to 1853 to 1854 inclusive; at the end of the first period, the balance of trade in favour of India was nearly forty-seven millions sterling, averaging nearly six millions per annum—this was partly liquidated by fifteen millions of bullion sent out, partly by the receipt of fourteen millions sterling into the East India Company's treasury in London, for which bills were given in India, and partly by other means. In the last period of five years, the balance in favour of India was nearly forty millions sterling, averaging nearly eight millions per annum. About nineteen millions of bullion were sent to liquidate this debt, or three and three-quarter millions per annum; the East India Company granted bills on India for sixteen millions, about three and a quarter millions annually, and about four and three-quarter millions remained to be paid by other modes. Now, in this state of the Indian trade, it would seem to be worthy the consideration of manufacturers in Europe whether they could send new products to lessen the large payments in bullion. The fabrics which had been exhibited to the Society that night, Pugrees, Sarhees, Doputtas, and Chookees, were worn by 150 millions of people, male and female, in India, and were manufactured entirely in India. Why should not our manufacturers at a less cost, by the aid of machinery, imitate these fabrics and pay for Indian products in these goods instead of bullion? There was a jargon abroad about the necessity for developing the resources of India; but the truth was, that at present the development was of that nature that the products of Indian industry could not be paid for by the products of the industry of other countries; and adjustments could only be effected by the employment of unusual amounts of the precious metals.

Mr. Bennoch having briefly returned thanks,

The Secretary announced that the paper to be read on the evening of Wednesday next, the 23rd instant, was "On Photo-Galvanography, or Engraving by Light and Electricity," by Herr Paul Pretsch. On this evening Roger Fenton, Esq., will preside.

THE EXAMINATIONS.

It having been represented to the Council, by several Institutions, that there does not exist in them classes for systematic instruction, but that some of the members of the Institutions are anxious to be allowed to compete at the ensuing examinations in June next, the Council have determined to suspend for the present the rule requiring all candidates to be members of classes at an Institute, but it will be absolutely necessary that every candidate should be at least a member of an Institute in Union.

Mr. Astrup Cariss, Secretary to the Liverpool Institute, in a letter to the Secretary of the Society of Arts on this subject says:—"I will here observe that Dr. Hudson's statement at the late meeting of the Institutional Association of Lancashire and Cheshire (at Manchester), to the effect that we consider our certificates of our pupils' progress as valuable as any which you are likely to give, was wholly unfounded. I do not mean by this to say what the opinion of our directors is as to the comparative value of our certificates and yours, but merely that nothing has transpired to authorise his statement. And, whatever may be the opinion of our directors on this point, they have at all events heartily approved of your scheme, and, following the example of the Leeds Institute, granted to the school committees £20 towards the expense of sending up a limited number of pupils who may satisfactorily pass a preliminary examination here."

Colonial Correspondence.

THE COMMERCIAL IMPORTANCE OF HONDURAS AS A BRITISH SETTLEMENT.

Belize, British Honduras
March 15th, 1856.

Sir,—I have, on previous occasions, brought under your notice different kinds of fibre, the productions of Yucatan, British Honduras, and Tehuantepec. That which appeared to me to be the most valuable was what is called in this country the silk grass. The plant from which it is produced grows spontaneously in marshy, shaded grounds, which we do not lack in this highly-favoured region, in very great plenty. I now send you another species of fibre, which I have received from the island of Ruatan—it is made from the stalk of the plantain tree. It is calculated that every stem will average about a pound of fibre; and as the trees in that island are much cultivated for the sake of the fruit, which is exported to New Orleans, this article, if of any value, would form a very important addition to its trade.

Whilst on the subject of the productions of Ruatan, one of the Bay Islands, perhaps I may be permitted to say a word or two in reference to that famous treaty, which will be known to future ages by the name of the Bulwer and Clayton, or the Clayton and Bulwer, according as it is spoken or written of by an Englishman or an American, about which our most esteemed friend and brother

Jonathan is erecting his quills so fiercely. He says that the British Government have violated that treaty, and he calls for a specific performance of all its articles, which performance, according to his interpretation, will involve the necessity of the English immediately quitting the shores of British Honduras, and giving up possession of the Bay Islands, that is Ruatan, Bonacca, and Utila. As a loyal subject of her most gracious Majesty Queen Victoria, and occupying a certain public position in this "Worthless Settlement," as the *Times* is pleased to call it, but in my opinion erroneously, I should like to put in a word or two on the subject.

Looking at the treaty as a legal document, construing it as I would construe a deed, a will, or an Act of Parliament, I unhesitatingly say that the treaty has not been violated in one single tittle. What was the design, intent, and object of the treaty? I will endeavour to show. Since the discovery of gold in California it has become an object of the utmost importance to the Americans to establish a shorter route to that part of the Union than the oceanic one by Cape Horn, and a less expensive one than the land transit across the Isthmus of Panama or Darien. The British Government, although not equally interested in such an undertaking, but viewing with a liberal spirit the contemplation of so noble a work, which would unite two oceans, and bring the productions of two parts of the world, at present so far apart, so much nearer to each other, and which would be so beneficial to commerce in general, cordially entered into the scheme, and offered to the Americans a hearty co-operation. It must, however, be borne in mind that the successful termination of such an undertaking would be to the United States a particular, immediate, and certain benefit, whilst to Great Britain it would be general, remote, and contingent. Various plans have been proposed. A railway across the Isthmus of Panama, a ship canal across the Isthmus of Darien, a railway across the Isthmus of Tehuantepec, a ship canal by the river St. Juan, and through the lake of Nicaragua, and lastly, a railway across the state of Honduras, which should commence at Port Caballos, in the bay of Honduras, on the Atlantic side, and terminate in the bay of Fonseca, on the Pacific side. Not one of these works has as yet been begun, or is ever likely to be, except the Panama Railway, and that, I believe, is nearly finished. There are physical difficulties connected with all these projects which cannot be overcome, and to which it is not necessary at the present moment to do more than allude. For the purpose of carrying out one of these schemes, but more particularly the ship canal across the Isthmus of Darien, in a fair and impartial manner, the United States Government, and that of Great Britain, determined to enter into a treaty, and they did enter into a treaty, and that treaty was negotiated on the one side by Sir Henry Bulwer, her Britannic Majesty's minister at Washington, and by Mr. Clayton, the organ of the Government of the United States, on the other. Mr. Clayton, Mr. Cass, Mr. Seward, and many other distinguished Americans, members of the Senate and of Congress, men of ability, of eloquence, of experience, and of honourable minds, say that by that treaty we engaged to evacuate the "Belize Settlement," as they call it, to give up possession of the Bay Islands, and to abandon the protectorate of the Mosquito kingdom. *I* say that by that treaty we are not called upon *to do anything of the kind*, as I hope presently to be able to show very clearly.

What did the contracting parties bind themselves to do or not to do by that treaty? They proposed to bind themselves not to acquire any *new* territory,—they did not propose to give up any which either of them *already possessed*. They contemplated the execution of a great public work, and they entered into a treaty, the intent and meaning of which were, that neither the one nor the other should *hereafter* acquire any territory, possession, or anything else which could give either an exclusive control over that work. They bound themselves, then, to abstain from all acquisition of territory—not on the Monro principle, because America was a party, but in order that neither of them should have a monopoly of the canal which they proposed to construct. Now, there can be no doubt whatever that that canal would have been far more beneficial to America than to Great Britain, and, that being the case, is it consistent with common sense that the latter power should come forward and say, "This canal will be of great benefit to you. It will enable you to arrive at your gold fields in California by a comparatively short route. We are rejoiced to be permitted to have the honour of co-operating with you in such a magnificent work, which will be a more durable memento than any Greek or Roman monument; but, lest you should suppose that we wish to have an unfair share of the advantages which will flow from it,—or, indeed, any share at all—we not only faithfully promise that we will not obtain any new territory in its vicinity, but we freely give up the settlement of Honduras, which we have had in our possession for the last 200 years; we make you a present of the Bay Islands, and for the future his sacred Majesty, George Augustus Frederick, king of the Cannibal—we beg pardon—king of all the Mosquitos, must take care of himself." Would this, I say, be consistent with common sense? There is not a tailor in Lothbury, nor a haberdasher in Ludgate, who would not say "that it did not stand to reason." What does the article of the treaty which we are accused of having violated, say? "The governments of the United States and Great Britain hereby declare, that neither the one nor the other will ever obtain, or maintain for itself, any exclusive control over the said ship canal." Here, then, the object of the treaty is plainly stated, "That neither the one, nor the other will obtain exclusive control over the said canal." "Agreeing," having that object in view, and for that purpose, "agreeing that neither will erect or maintain any fortifications *commanding the same, or in the vicinity thereof.*" Have we erected any such fortifications commanding such canal? That, I should think, even Mr. Cass would not say, as the canal itself does not exist, and it is more than probable that it never will. Well, then, we have not violated that part of the treaty. It goes on—still in the future tense,—"or occupy, or fortify, or colonise, or assume, or exercise any dominion over Nicaragua, Costa Rica, the Mosquito coast, or any part of Central America." Have we done that? I say, no. Central America consists of five states, viz., Nicaragua, Costa Rica, San Salvador, Guatimala, and Honduras. Only two of these states being mentioned in the treaty, the words "or any part of Central America" signify "or any of the other states," that is Guatimala, San Salvador, or Honduras. This clause must be construed according to its obvious meaning. The term Central America has always been confined to the states above mentioned. A native of Central America is always understood to mean a native from those states. In this article there is not one word mentioned about the relinquishment of dominion,—it is confined entirely to the obtaining of it,—and for what purpose? In order that neither party should have an exclusive control over the ship canal. Can it be shown that the possession of British Honduras and the Bay Islands,—supposing the ship canal were completed, and it is not yet begun—would give the British Government an exclusive control over it—a control not being prohibited, but only an exclusive one? A glance at the map will satisfy any one of the absurdity of such a notion. If the governments of France and Great Britain were to co-operate in the construction of a railway through Spain, and it was agreed by treaty that neither party should obtain or exercise any dominion which would give an exclusive control over that railway, the Emperor of France might just as well insist upon our giving up the Isle of Man, as the government of the United States call upon us to give up the British settlement of Honduras or the Bay Islands under the Bulwer and Clayton treaty. But suppose we were to abandon our claim to those territories, to whom should we give them? To the Americans? that would be an infraction of the treaty. To old Spain? she cannot keep what she has already got. There is only one other state that can have a shadow of a pretension to it,—that is Guatimala. But Guatimala acknowledges our right, and sends a consul to Belize. To whom should we give the Bay Islands? It is well known that they never were in the possession of any one of the states of Central America. Ages ago they were found unoccupied, and taken possession of by the English, in the name of the British crown. But Mr. Cass says that they have been colonised since 1850. Never was there a greater error; it can be distinctly proved that, in the year 1741, commissioners were appointed by George II. for the Government of the islands of Ruatan and Bonacca.

I think that, so far, I have shown, taking into consideration its design and object, that we have not violated the Clayton and Bulwer treaty. But they say that, in continuing our protection to the king of the Mosquito Indians, we are violating that treaty. Now, what does the treaty say upon this point? "nor will either make use of any protection which either affords, or may afford, or any alliance which either has, or have, with any state or people." From this it is clear that a protection is not prohibited. It goes on, "for the purpose of erecting or maintaining any such fortifications, or of occupying, fortifying, or colonising Nicaragua, Costa Rica, the Mosquito coast, or any part of Central America, or of assuming, or exercising dominion over the same." This part of the article, Mr. Clayton, Mr. Cass, and the rest of them, say we have violated, inasmuch as we continue to extend our protection to the King of the Mosquito Indians. But is it not as plain as the sun in the heavens, that the article does *not* prohibit such protection, but that it prohibits the making use of that protection for the purpose of raising fortifications, &c. When, then, it can be shown, that the British Government makes use of the protection which it gives to the King of the Mosquito Indians, *which protection the treaty permits*, "for the purpose of erecting fortifications, or of occupying, fortifying, or colonising Nicaragua, Costa Rica, the Mosquito Coast, or any part of Central America, or of assuming or exercising dominion over the same;" when, I say, it can be shown that the British Government have made use "of the protection which it affords, or may afford" to the Mosquito king, to do all or any of these things, then let them say that the treaty has been violated. But nothing of the kind has been done. The protection, which by the treaty we are allowed to extend to the Mosquito king, has never been "made use of" for any one of these purposes. I have already said, that the sole object of the treaty was to prevent either party from obtaining a monopoly of, or an undue control over, the ship canal. The treaty is not *absolute*, but *relative*, and the thing to which it relates is the ship canal. Take away that thing, and it falls to the ground. It has no existence without it. Wherever the canal is, there the treaty will be in force. Where, then, is the canal? In Utopia—or in that particular planet which is set apart for the reception of discarded projects, which, doubtless, is the "fool's paradise" which Milton sung. There, also, is the treaty. It is utterly impossible to view the subject in any other light. If I agree with my good friend and neighbour farmer Tomkins, to cut a canal across a certain part of the country to an adjacent town, in order that we may have a cheap and expeditious mode of sending our pigs and poultry to market, and, to prevent either of us from having an exclusive use of such canal, we mutually covenant that we will not purchase any of the land through which it shall pass, and afterwards the undertaking is abandoned, either because there are insurmountable difficulties in the way, or because another channel has been considered preferable, can it be said that I am precluded from purchasing or otherwise acquiring the possession of a turnip field through which the canal would have flowed had that canal been dug? I do not think that any court of justice in the world would so decide. I am quite sure that the Governor of Baratraria, whose enlightened judgments have met with an able and correct reporter, would not have been of that opinion.

The Clayton and Bulwer treaty was a conditional obligation, and the ship canal was the suspensive condition. If that condition was not accomplished there was no obligation. Pothier says, "The effect of a condition is to suspend the obligation until the condition is accomplished or considered as accomplished; till then nothing is due. There is only in expectation that what is undertaken will be due, *pendente conditione nondum debitur, sed spes est debitum iri.* Therefore, a payment made by mistake before the accomplishment of the condition, is subject to repetition, &c." Vattel, writing on the "interpretation of treaties," says, "The reason of the law, or the treaty, that is *the motive which led to the making of it, and the view there proposed*, is one of the most certain means of establishing the true sense, and great attention ought to be paid to it whenever it is required to explain an obscure, equivocal, and undetermined point, either of a law or of a treaty, or to make an application of them to a particular case. As soon as we certainly know the reason which alone has determined the will of him who speaks, we ought to interpret his words, and to apply them in a manner suitable to that reason alone, otherwise he will be made to speak and act contrary to his intention, and in a manner opposite to his views. In virtue of this rule a prince who, on granting his daughter in marriage, has promised his future son-in-law succours in all his wars, owes him nothing if the marriage does not take place." I ask, then, what was the motive which led to the making of the Bulwer and Clayton treaty; what was the view which the contracting parties then proposed? The motive was, as I have before stated, the furtherance of a great commercial undertaking—the accomplishment of a noble work, which should be a perpetual monument of the energy and enterprise of two great nations, and the prevention of either party from having an "exclusive control over that work." It follows, then, from what has been said, that if the work itself falls to the ground, the treaty, as a necessary consequence, must go along with it. "We will not acquire such dominion as will give us an exclusive control over the canal." That is what we say. We do not say we will relinquish all the dominions and territories which we already possess, which are not calculated to give an exclusive control over the said canal, neither do we bind ourselves not to acquire in future any dominion which is not calculated from its nature and position to give us that control. The interpretation which certain American statesmen and writers put upon the Clayton and Bulwer treaty is a forced one—it is an interpretation which the plain, obvious sense of its language will not justify. There is no question that they take a mistaken view of it. But some of their own journalists ascribe to them motives and conduct of which I, who entertain a high opinion of the morality of the public men of the United States, cannot believe them capable. But, whether capable or not, it is a proof, at all events, that even in America all do not think alike upon this subject. The *New York Tribune* says, "For our own part we believe that it never was the intention or expectation of the British negotiator of the treaty to surrender the protectorate of Great Britain over the Mosquitos. We believe that Mr. Clayton never approached this topic in his negotiations with Mr. Bulwer, knowing full well the position which that minister occupied on that point, but that he cautiously avoided it, intending to obtain by indirection and diplomatic wiles what he knew would not be knowingly yielded in unequivocal terms. We have reason to believe that Mr. Clayton chuckled not a little at what he deemed his success over the British diplomatist, and was not altogether complimentary in the terms he applied to the astuteness of that functionary."

If this be true of Mr. Clayton, which I for one do not believe, comment upon such conduct would be unnecessary.

Mr. Bright, in a speech which he lately made at the Manchester Chamber of Commerce, said:—"We have got a small town of 400 or 500 houses, called Belize, at the mouth of the river Belize, and two small islands, which are, perhaps, of no value at all." As I am quite sure that that gentleman would not knowingly make a misstatement, he will not be angry if I set him right upon this matter. Belize contains a ranging population of from 5,000 to 8,000 inhabitants; it stands upon a very large space of ground, and possesses, at the lowest computation, 1,500 houses. There are two handsome churches belonging to the Establishment, a Roman Catholic Chapel, a Baptist Chapel, and a Wesleyan Methodist Chapel. The houses of the respectable portion of the inhabitants are, for the most part, large and elegant structures, having wide verandahs in front. The streets are clean, wide, and airy, and the general appearance of the place, particularly if viewed from the harbour, shaded as the variously-coloured houses are by waving cocoa-nut trees, with here and there a tall mountain cabbage, is picturesque and pleasing. A very extensive trade is carried on in Belize, and it is the *entrepot* for nearly all the dry goods which are imported into the neighbouring state of Honduras. Some of them also find their way to the other states. Fortunes have been very rapidly made in this town. A few years ago a Frenchman, called Eugene Rayal, came to Belize; he had no money, nor property of any sort, except a small diorama, which he went about exhibiting. A gentleman had a dinner party, and to amuse his guests he sent for Monsieur (the Creoles called him "Mushy") to exhibit his diorama. Mushy came, and, after the show was over, got into conversation with the gentleman of the house, in the course of which it transpired that he was well acquainted with the mystery of bread-baking; he was advised to discard the diorama, as a vain show, and rely for a subsistence upon the more substantial staff of life.

The counsel was good, and he adopted it, the aforesaid gentleman advancing him a sum of money to enable him to commence operations. Mushy made excellent bread, and, in a short time, none but his would go down. Whilst he was thriving in the "floury paths" of bread-baking, having arrived at the dignity of "master of the rolls," it accidentally became known that he had an equal genius for the *cuisine*. His talents in that department were immediately put in requisition, and he gave so much satisfaction that no dinner was considered perfect without some of Mushy's artistic "combinations." Months rolled on, and Mushy had a store well stocked with all kinds of good things. A few more months, and Mushy's wife suddenly started into existence. A few more, and there was another store, and yet another, and Mushy was growing laterally in a most surprising manner. But, to make a long story short, as an Irishman would say, in a few years Mushy was able to retire from business with a sum not far short of £10,000. He went to New Orleans and bought houses, in which city he now lives in great comfort and rotundity. He occasionally visits Belize, however, where he has established a son in business. As Monsieur Rayal, wearing a shiny black hat, with umbrageous brim, a glossy coat, of the most approved Yankee cut, a white waistcoat, and a gold chain, which would serve as a cable for a moderate-sized vessel, and with a broad grin upon his honest expansive face, he offers, in full confidence that it cannot be rejected, his fat hand to be shaken by those whose dinners he formerly cooked for a "consideration." Another Frenchman, whose name was Bessard, left Belize a short time ago, having cleared in three years £12,000. These are only two instances. I could mention many others. A place, then, cannot be so very paltry, in which men, such as I have mentioned, can raise themselves, by honest industry, from nothing to a very comfortable position, in so short a space of time. The amount of the exports and imports, and the quantity of shipping employed in the Honduras trade, will best show whether or not Mr. Bright was justified in sneering at Belize, and recommending the British Government to abandon it, and the *Times* newspaper in calling it a "worthless settlement." In the year 1853, the total amount of the exports from Honduras to Great Britain, the United States, and other countries, was £345,377. In 1854, the total amount was £452,313. In 1853, the total amount of outward ships was 23,936 tons. In 1854, it was 27,803 tons. The number of men employed in the former year was 990; in the latter, 1,132. In 1854, the total amount of the imports was £2,417,642. The inward ships in that year from Great Britain, the United States, and other countries, amounted to 31,124 tons, and the number of men employed was 1,259. Now, I think that a place employing such an amount of British shipping, and importing manufactured articles, principally British, to the amount of nearly two millions and a half yearly, is not altogether to be despised.

During this Central American controversy, British Honduras has been termed the "Belize settlement." That settlement, however, extends from the Rio Hondo on the north as far as the river Sarstoon on the south, being a distance of at least 250 miles of sea-coast, and it is believed to extend backwards 150 miles. Why, then, is this to be called a "worthless settlement?" I have no hesitation in saying, from the great number of splendid rivers which it contains,—from its stores of vegetable wealth of spontaneous growth,—from its immense forests in which most valuable woods are found,—from the richness and variety of its soil,—that it is equal in importance to any other colony belonging to Great Britain. Then, again, why speak in such disparaging terms of the Bay Islands? These islands, as I said before, are three in number, viz., Ruatan, Bonacca, and Utila. Ruatan is the principal one. It is about twenty-two miles in length, and about eight or nine in breadth. It is a very beautiful and fertile island, and contains at present not less than 3,000 inhabitants. A considerable trade is carried on between it and New Orleans in plaintains, cocoa nuts, and oranges.

I have the honour to be, Sir,
Your very obedient servant,
R. TEMPLE, Chief Justice.

Home Correspondence.

BOYDELL'S TRACTION STEAM-ENGINE FOR AGRICULTURAL PURPOSES.

Sir,—I devoted two days last week to the examination of the operation of this machine as a locomotive and tractive power, and have come to the conclusion that it is "a great success." This success is owing to the endless and wide railway attached to the circumference of the wheels, which gives a fulcrum for the lever, and a bearing sufficiently wide to carry a great weight on soft ground without imbedding in the soil. Hence the avoidance of friction and clogging; we might illustrate this by a sportsman on the mud oozes, whose feet would sink in, and thus render his power unavailable, but by attaching to his feet wide pieces of board, the pressure is diminished to a bearing condition. Thus, in the case of Mr. Boydell's machine, although it weighed nine tons, its impress was scarcely perceptible where a horse's foot left a deep indentation. This is a most important desideratum, seeing that weight in a traction engine is indispensable. We can form some idea of the value of this implement when we reflect that a common portable agricultural threshing engine, which only weighs three tons, requires two horses to draw it on the common road, while two more are required to draw the thrashing machine.

Mr. Boydell's engine walked from Camden-town to Acton, taking in tow its four-wheel waggon, with coals, and four heavy iron ploughs, and water enough for four hours' work. When on the soft turnip-field (after a night's rain) it drew after it ploughs, scarifier, &c., with perfect ease, and then walked home again to Camden-town.

It can ascend an acclivity of one in three, which is nearly walking up stairs, our stairs being one in two. It can back, advance, or stop instantaneously, the pinion being shifted from the cogs of the driving-wheel, and the power thus suddenly released is carried off by a separate fly-wheel, which may be used for driving threshing-machines, mill-stones, or other purposes.

In fact, instead of a farmer sending for and sending back a 6-horse power engine and threshing machine, requiring in each trip four horses, this machine will move itself any where—draw the corn to market, bring home manure, and do the cultivation and work of the farm.

I hope a company will be formed for its development, Mr. Boydell having expended nearly ten thousand pounds in accomplishing his object.

A full description of it is given in the *Mark Lane Express* of the 7th instant. It may briefly be described as a horizontal engine, mounted on wheels, with a man to steer in front and the engineer behind. The two cylinders were 6½ by 10, worked at 60lbs. per inch, with a quick movement, and estimated at 16 horse power. 20lbs. of steam was required to keep the machine moving, the other 40lbs. for traction. Messrs. Boydell and Glazier's works are at Camden Works, Camden-road. The machine can turn as easily as a common waggon, and does not mind a deep furrow or a side hill. It will evidently require a sort of railway buffer spring at starting, to avoid breaking the chains which attach it to its load.

I am, Sir, your obedient servant,
J. J. MECHI.

Tiptree-hall, Kelvedon, Essex, 10th April, 1856.

P.S. It was a remarkable and significant fact, that although public notice in the papers had been given of the intended trial at Acton, there were very few members of either the London Farmers' Club or Royal Agricultural Society present. I hear that Messrs. Garrett and Sons made the engine that drove the machine. Mr. Boydell told me that on its return journey it was met by a waggon-load of grain drawn by six horses. The horses swerved at the sight of the machine, and drew the wheels into a soft place, from which seven horses could not extricate it; but he hooked on the traction engine, and drew it out with ease.

TEST OF STEEL MANUFACTURES.

Sir,—Your last number contains a singular letter from "Chalybs," on a variety of subjects more or less connected with steel manufactures. I shall not follow the writer through the *multifariousness* of his epistle. Neither shall I enlighten your readers on "rattening," that not forming any part of the paper read before your Society in the presence of "Chalybs." On one subject, however, I will offer a few remarks, to remove any wrong impression that may exist either in the minds of your readers or that of your correspondent. The latter appears to think that education lessening the number of the ignorant, will be the surest check to the system of imposition, which, in common with others, he deprecates. Now, I distinctly stated that there did not exist any popular test to judge of the quality of steel manufactures. And I humbly submit that the education he suggests can never become popular or common. Everybody who desires that knowledge must be intimately acquainted with the details of manufacture, which is quite impossible to any considerable portion of mankind.

By way of testing the point, I beg to forward to you three specimens of polished steel articles. Now, let "Chalybs," or any "educated" man, point out the best of the three, and also state the defects of the other two, assuming that they are not all equally good. Or let him point out the bad one, and tell me the good properties of the remainder. The articles are marked respectively I, II, III. I place the key of their qualities in your hands, and await the judgment of the "educated" men.

Yours, &c.,
James Wilson.

Sheffield, April 15, 1856.

To Correspondents.

Errata in last number, in Mr. Mechi's remarks, page 362, col 2, line 39, for "steel pins" read *steel pens;* and page 363, col. 1, line 12 from bottom, for "unwise enough to *lose* the importation, &c.," read "unwise enough to *tax* the importation, &c."

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. Lankester, "On the Recent Progress of Vegetable Physiology."
Chemical, 8.
Statistical, 8, Mr. W. B. Hodge, "On the Mortality arising from Military Operations."
Royal Inst., 9, Dr. Sandwith, "On the Siege of Kars."

Tues. Royal Inst., 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½, Anniversary.
Civil Engineers, 8, Mr. F. M. Kelley, "On the Junction of the Atlantic and Pacific Oceans, by a Ship Canal through the Valley of the Atrato."
Medical and Chirurgical, 8½.
Zoological, 9.

Wed. Antiquaries, 2, Anniversary.
London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphosis of Insects."
Royal Society of Literature, 3, Anniversary.
Society of Arts, 8, Herr Paul Pretsch, "On Photo-Galvanography, or Engraving by Light and Electricity."
Geological, 8, Mr. G. P. Scrope, "On the Formation of Craters, and the Nature of the Liquidity of Lavas."

Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Numismatic, 7.
Royal, 8½.

Fri. Philological, 8.
Royal Inst., 8½, Mr. W. B. Donne, "The Works of Chaucer considered as Historical Illustrations of England in the 14th Century."

Sat. London Inst., 3, Mr. E. W. Brayley, "On Geology."
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 10th April, 1856.

Par. No.
90 (6). Civil Services Estimates—Class 6.
109. Compulsory Vaccination—Copy of a Letter by John Gibbs, Esq.
139. Ionian Islands—Return.
141. Bay Islands—Return.
Medical Charities (Ireland)—4th Report of the Commissioners.

Delivered on 11th April, 1856.

41. Local Acts (26, Cork Bridges, Waterworks, and Improvement; 27, Perth Burgh and Harbour)—Admiralty Reports.
140. Tasmania—Correspondence.

Delivered on 12th and 14th April, 1856.

129. Court of Chancery (Suitor's Fund)—Return.
133. East India—Return.
142. Public Income and Expenditure (Year to 31st March, 1856)—Account.
144. Judicial Bench (Ireland)—Return.
147. British Museum—Accounts.
145. Vaccination—Return.
84. Bills—Poor Law Amendment.
91. Bills—Medical Qualification and Registration.
93. Bills—Dissenters' Marriages (amended).
94. Bills—Education (Scotland).
95. Bills—Parochial Schools (Scotland).
96. Bills—Poor Law (Ireland).
Prisons—18th Report of the Inspectors (Northern and Eastern District)—Part 2.

Delivered on 15th April, 1856.

138. Commissariat Accounts—Return.
97. Bill—Agricultural Statistics.

Delivered on 16th April, 1856.

112. Superannuation (Public Office)—Account.
143. Poor Laws (Ireland)—Return.
Public General Acts—Cap. 11, 12, 13, 14, 15, and 16.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette April* 11*th*, 1856.]

Dated 25*th March*, 1856.

702. John Bromley, Shelton, and William Adams, Etruria—Improvements in ovens used for firing porcelain and other kinds of earthenware.

704. John Aspinall, Limehouse—Improvements in apparatus for obtaining extracts and decoctions.

706. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for raising nap or pile. (A communication.)

708. George Hallen Cottam and Henry Richard Cottam, Old St. Pancras-road—Improvements in the manufacture of chairs, bedsteads, and other articles to sit and recline on.

710. George Hedgcombe Smith, North Perrot, near Crewkerne—Improvement in the manufacture of saucepans, kettles, and other like culinary utensils.

712. Robert Collins, Trent—Improved agricultural implement.

714. George Wailes, 10, Palace-row, New-road—Improvements in the means of actuating valves used for regulating the passage of gas or water in pipes.

Dated 26*th March*, 1856.

715. Matthew Weston and Orlando Carter, Rochdale—Improvements in machinery or apparatus for setting saws.

716. Joseph Liley, 5, Gutter-lane—Improved case or sliding-tube for candles, telescopes, opera-glasses, and is especially applicable to portable articles for the toilet in travelling, and is called 'Debas-cylindrical-etui.' (A communication.)

717. Alexandre Tolhausen, 7, Duke-street, Adelphi—A new process of producing chemical writing, and of marking and inscribing chemically any characters or figures upon paper or other substance of similar character. (A communication.)

718. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved mode of manufacturing porous earthenware. (A communication.)

719. William Armand Gilbee, 4, South-street, Finsbury—Improvements in the manufacture of glass. (A communication.)

720. Thomas Barnabas Daft, Seville Iron Works, Dublin—Improvements in the manufacture of metallic and other bedsteads and articles of metallic and other furniture.

721. David Lowe, Leicester—Improvements in knitting machinery.

722. George Smith, 9, Manor-road, Newington—Improvements in 'envelopes' for containing letters or documents.

723. Patrick Scott Rankin, Glasgow—Improvements in communicating or transmitting motive power.

724. William Robert Barker, Chapel-street, and William Toogood, Mount-street—Improvements in bottles, or in stoppering bottles, jars, and other receptacles.

725. James Rock, jun., Hastings—Improvements in carriages, parts of which are applicable to other structures.

726. William Edward Newton, 66, Chancery-lane—Improved apparatus for exploring under water. (A communication.)

727. Wm. Clayton, Watling-street—Improved manufacture of soap.

728. William Edward Newton, 66, Chancery-lane—Improvements in macerating substances to be employed in the process of distillation. (A communication.)

Dated 27*th March*, 1856.

729. James Taylor and James Galloway, Bolton-le-Moors—Improvements in gauges for indicating pressure.

730. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in watches and other time keepers. (A communication.)

731. Joseph Tall, Islington—Improvements in blind rollers, and in fixings for the same.

732. William Nicholls, Raunds, Northampton—Improvement in the manufacture of boots and shoes.

733. Richard Durant Cumming, St. James's, Middlesex—A footstool and hassock combined. (A communication.)

734. Bonnet Frédéric Brunel, Hampstead-road—Improvements in the manufacture of prussian blue.

735. James Cliff, Burton-upon-Trent—Improvements in machinery for cleansing casks.

736. William Ball, Chicopee, Hampden, U.S.—Improvements in machines for separating copper and other metals from their ores.

737. Allen Levinston Hill, Birmingham—Improvements in furnaces for steam-boilers, japanners' stoves, and other such like purposes.

738. Edward Bufton, 122, Piccadilly—Improved ink for marking linen and other fabrics, and in the case or holder for containing the same and the implements to be used therewith.

740. William Frederick Thomas, St. Martin's-le-Grand—Improvements in sewing machines.

Dated 28*th March*, 1856.

741. Joseph Auguste Barratt, 39, Rue de l'Echiquier, Paris—A new rotatory steam-engine.

742. John Conrad Meyer, Paris—Improvements in the construction of vices.

743. William Ward, Warrington—Improvements in apparatus for lubricating the spindles of certain machines, and in preparing and spinning.

744. Alfred Daniel, Moorfields, Wolverhampton—Improvements in the manufacture of keys and locks.

745. Joseph Webber, Torquay—Improvements in generating steam.

746. John Charritie, Cannon-street, and William Smith, 10, Salisbury-street, Adelphi—Improvements in the manufacture of small shot. (A communication.)

747. James Harrison, Geelong, Victoria—Producing cold by the evaporation of volatile liquids in vacuo, the condensation of their vapours by pressure, and the continued re-evaporation and re-condensation of the same materials.

749. James Harrison, Geelong, Victoria—Distilling or evaporating in vacuo condensing the vapour by pressure, and economising heat.

750. Alfred Trueman, Swansea—Improvements in treating argentiferous regulus.

751. Alfred Vincent Newton, 66, Chancery-lane—Improved air engine for producing motive power by heated air. (A communication.)

Dated 29*th March*, 1856.

753. Charles Wye Williams, Liverpool—Improvements in the application of air propelling or exhausting apparatus for ventilating and like purposes on board steam vessels.

755. Francis Puls, Soho-square—Improvements in galvanic batteries.

757. Robert Powell, 2, Peter's-place, Saint Martin's-lane—A new method of making up cotton, linen, silk, woollen, and other textile fabrics, whether waterproofed or not, into wearing apparel, horse clothing, tents, tilts, and all other articles or things for which such fabrics are used, by which method the article or thing when made up and worn is perfectly ventilated.

759. William Muschamp, Tyne Paper Mill Company, Gateshead—Improvement in the manufacture of paper in order to render the same waterproof.

761. John McLean, Glasgow—Improvements in treating or preparing textile fabrics and materials for increasing the density thereof.

763. William Nimmo, Pendleton—Improvements in the manufacture of textile fabrics.

WEEKLY LIST OF PATENTS SEALED.

Sealed April 11*th*, 1856.

2273. William Andrew Fairbairn and George Haslam.
2275. Peter Spence.
2288. James Septimus Cockings and Ferdinand Potts.
2303. Samuel Kent.
2317. Henry Bessemer.
2319. Henry Bessemer.
2321. Henry Bessemer.
2323. Henry Bessemer.
2325. Henry Bessemer.
2327. Henry Bessemer.
2333. Charles Edwin Jones.
2399. Simon O'Regan.
2423. William Henry Walenn.
2431. Robert Cook.
2481. George Burridge.
2511. Charles Allen Browne.
2653. Charles Sanderson.
2881. Evan Evans.
2883. Philip Antrobus.
2905. Isaac Atkins and Marmaduke Miller.
91. Charles François Leopold Oudry.
121. David Dring.
129. William Chapman.
243. Samuel Palmer Gladstone.
297. Rudolph Bodmer.
307. George Cumins Thomas.
423. William Aristides Vérel.

Sealed April 15*th*, 1856.

2302. Thos. Weatherburn Dodds.
2304. Robert Benton.
2310. William Church.
2311. Edwin Wilkinson.
2312. John Forrest.
2314. Théodore Augustin Claude.
2329. John Talbot Pitman.
2330. Thomas Taylor.
2331. John Adcock.
2332. Thomas Richards Harding.
2350. Thomas Craven & Matthew Pickles.
2356. Hypolyte Gaudibert.
2370. Thomas Roberts and John Dale.
2448. John Cottrill.
2490. Richard Goose.
2702. Edward Daniel Johnson.
2703. Auguste Dusautoy.
2. Ferdinand Swift.
268. John Barker Anderson.
326. Franklin Prestage.
416. Stephen Fitchew Cox.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

April 7*th*.

886. Nathaniel Clayton and Joseph Shuttleworth.
912. David Zenner.
942. John Chatterton.

April 9*th*.

917. William Wilkinson.
967. William Edward Newton.

April 10*th*.

889. Thomas Edwards.
962. George Albemarle Cator.
928. Henry Wilks.
962. Henry Carr.

April 11*th*.

895. Charles Clifford.
897. Thomas Lovell Preston.
901. John Chadwick and Thomas Dickins.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3826	April 10.	Insect Trap	Elieser Edwards	Birmingham.
3827	April 12.	Improved Pressure Guage	Richard Pease	Bradford, Yorkshire.
3828	April 15.	Guard for Penholder	James Lowe and Maurice Pollock	Birmingham.
3829	April 16.	Reclining Chair	John Manuel	Sheffield.

Journal of the Society of Arts.

FRIDAY, APRIL 25, 1856.

NINETEENTH ORDINARY MEETING,

Wednesday, April 23, 1856.

The Nineteenth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 23rd inst., Roger Fenton, Esq., in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Barnes, Richard
Barnes, William
Brackenbury, Rev. John Matthew
Goderich, Viscount, M.P.
Gretton, John
Yarnold, John

The following Institution has been taken into Union since the last announcement:—

418. Richmond (Surrey) Parochial Library and Reading Room.

The paper read was—

ON PHOTO-GALVANOGRAPHY; OR ENGRAVING BY LIGHT AND ELECTRICITY.

By Herr Paul Pretsch, late Manager of the Imperial Printing Office, Vienna.

In the present century the agents, light and electricity, have assumed an importance in science and art unknown to previous ages. They constitute at present the leading subjects of scientific investigation. The social influence exercised by their applications has caused light and electricity to be regarded as essentials, not merely on account of the position they hold in the physical universe, but because they have become the ready servants of our will. It is not necessary to enumerate here applications which are familiar to all. The present paper has reference to an application in which both agents are mainly concerned in producing a desired result, an application, too, the social bearings of which, it is humbly conceived, will be of no mean importance. Photo-galvanography, or engraving by light and electricity, forms the subject of this paper.

Having been for many years engaged as Manager of the Imperial Printing Office, at Vienna, the productions of which were so greatly admired in the Great Exhibition of 1851, I have turned my attention to rendering the discoveries and results of science applicable to several graphic processes and to printing purposes. Very soon after the introduction of photography, I felt the importance of this beautiful art in re-producing and imitating most of the wonderful productions of nature and art, and I saw plainly enough that photography could assist the real artist in the creations of his own mind or in multiplying his works. I was entrusted to set up a photographic establishment at the Imperial Printing Office, and I was fortunate enough at the Great Exhibition of 1851 to gain a prize medal. The pictures there obtained have been chiefly used as originals for engraving on steel, copper, wood, or for the lithographic draughtsman. The result of my attention to this subject was the idea of producing by means of photography a plate from which we might print with common printers' ink. Many learned and scientific investigators throughout Europe were equally impressed with the importance of such a result. Permit me, therefore, to mention here the valuable labours of my predecessors, and the methods which they have adopted for solving the problem.

Dr. Berres, in Vienna, who died shortly after his important investigations, was one of the first in this field. He executed at a very early period in photography some prints from etched daguerreotypes possessing great merit. He used a solution of gum arabic and nitric acid. About that time there was in existence a process which gave very perfect but faint results; it consisted in the use of bichromate of potass with the addition of aqua regia, fixed by washing with ammonia. I am unable to give the details of this process.

Mr. W. R. Grove, in London, used the daguerreotype plate as the anode in a decomposing trough filled with diluted muriatic acid, and as the cathode a platinum plate, both plates being connected with a single cell galvanic battery.

M. Fizeau, in Paris, has also tried to solve the problem. He etched his daguerreotype plates by covering them with a mixture of nitric, muriatic, and nitrous acids, or with a mixture of nitric acid and nitrate of potass and chloride of sodium. He repeated the process several times, cleaning his plate each time with caustic ammonia. The faint etched lines or tints were afterwards filled with printers' ink, capable of rapidly drying; the whole surface of the plate was then gilt, the dried ink removed, and the plate etched with nitric acid. All these investigators have used daguerreotypes upon silvered copper or real silver plates; they all were struck with the minuteness and beauty of the details, but they complained of the faintness of the etched parts, and confessed that no printer's ink could enable them to reproduce the beauty of all the parts visible upon the plate.

I have the honour to lay before you two prints of daguerreotype plates, etched as above-mentioned. They were executed about ten years ago, in Vienna.

Within the last six years, several trials, with a similar object in view, have been made at the Imperial Printing Office at Vienna. The medallion which I now show you was executed by me upon copper, in 1850. This was thus produced;—A fresh made and unfixed positive (upon common paper, prepared in the usual way, with chloride of sodium and silver) was transferred by pressure to a clean copper-plate, then treated or developed with a solution of ammonia, then exposed to or etched by the vapour of iodine, after which it was finished by the hand of an experienced aquatint engraver.

I have here another specimen of an etched daguerreotype picture, executed in 1854 in the same establishment. A perfect picture is taken upon silvered copper, or upon real silver; the four edges are bent up for convenience in manipulation, and the picture is fixed in the common way by hyposulphite of soda. From this time until the end of the etching process the plate must not be allowed to become dry. When fixed, the plate is placed upon a stand in a horizontal position, and warmed, until what remains of the hyposulphite of soda begins to evaporate. The solution is then poured off, and the plate is washed several times with distilled water, which must be also heated. Then a weak solution of gum arabic is poured upon the plate, to which is added the etching mixture, consisting of two solutions—viz. 1 part of pure nitric acid 45° Beaumé, and 11 parts of water; 2 parts of pure chloride of sodium, 1 part pure nitrate of potass, and 40 parts of water. Of these solutions, take 9 parts of the diluted acid, and 1 part of the solution of salts. This etching liquid must be well distributed over the gum solution upon the plate, which may be done by using a pointed glass tube, and by sucking in and blowing out the fluid. The plate is warmed, and the solutions moved several times; the picture vanishes, but appears again of a black-blue tint upon a white-grey ground. It is then washed with water, again warmed, and a diluted solution of ammonia is poured on, which is allowed to remain upon the plate until all the chloride of silver in the etched parts is removed. The plate is again washed with water, then a diluted solution of iodine is poured on it, and it is afterwards warmed until it becomes yellow; it is again washed, and the iodine removed by hyposulphite of soda, and afterwards washed and dried. The etched plate so obtained is very faint, and although an ink specially prepared for the purpose has been used, consisting of a mixture of wax, turpentine, and plumbago, a specially prepared glossed paper, and a special mode of printing, the impressions still exhibit faintness.

I now turn to the valuable investigations of M. Niepce de St. Victor. His process consists in the employment of bitumen of Judea, dissolved in etheric oils, as a coating for a steel plate. The coating when dry is exposed, with the object to be copied, in a copying frame, to the influence of the light. After sufficient exposure, the plate is washed with similar etheric oils. It is next finished by etching and engraving. The last exhibition of the Photographic Society showed some specimens executed in this method by M. Negre, in Paris.

Lerebour, Barreswill and Lemercier have applied bitumen and resinous substances in a similar manner on the lithographic stone, with the exception, however, that the stone requires a different method of treatment after exposure.

While on this subject, I may mention an original idea, published in Germany by M. Halleur. He took a lithographic stone grained for chalk-drawing, and prepared its surface by washing it with a very diluted but neutral solution of oxalate of iron. This he repeated several times. After the solution was sufficiently soaked into the stone, the moist or damp stone was exposed in the camera. The time of exposure varied. When sufficiently exposed, the picture appeared in a brownish colour upon the stone. It was washed and fixed by a solution of carbonate of ammonia, and finished by being well washed with water. The picture was then upon the stone, and had to be prepared, that is to say, it must be made capable of taking the fatty ink, save in the white parts that must remain clean. This was done by washing the surface with a very diluted solution of oxalic acid. The stone was then treated like a common lithographic stone.

The peculiarity discovered by M. Niepce, that the vapour of iodine adhered to the black parts of a print or drawing, has been applied by Messrs. Salmon and Garnier to the production of etched plates for copperplate-printing, or of prepared plates for chemical printing, such as zincography, &c. The last mentioned gentlemen have also proposed to submit a brass-plate to the vapour of iodine, and then to place the photographic original upon the plate for the purpose of exposing the arrangement to the influence of the light. Where the plate has been protected from the light (all the dark parts of the picture) mercury can be amalgamated; but it refuses to attach itself wherever the iodine has been influenced by the light (the white or light parts). I have not seen any specimens by this method.

Lastly, I have to mention the investigations of Mr. Fox Talbot, to whom the art of photography owes already so much, and to whom are justly due the thanks of the scientific world. I mention this gentleman last, because some materials of his process are used in my method, although in another way and for another result. He uses gelatine and bichromate of potash for the purpose of what may be termed a photographic *etching* ground. The leading idea in his process is etching,—he obtains the desired result, viz., an etched surface, by the use of bichloride of platinum for the purpose of biting into the steel the copy of the picture.

Having given the foregoing brief *resumé*, it remains for me to observe that any process, the results of which are dependent upon etching, is uncertain from that very cause. Etching, it is well known, cannot be properly completed in one operation; it is necessary to etch and re-etch to obtain different tints, by which means the real touch of nature or art is likely to be sacrificed. In the process which I have now the honour to lay before you—the method of etching is abandoned, the fundamental principle being the possibility of producing photographically on the material used a printing surface of relievo and intaglio parts, instead of a mere picture made up of lights and shades. In this process the picture appears at once in all its depths, tints, half tints, and chiaroscuro. The plate serves only as a basis for coating, while the plate itself is not at all altered by the process. I can use the same plate over and over again, until it is broken or otherwise spoiled.

I took out a patent in England November 9th, 1854, and in France, June 1st, 1855, and, therefore, some time before M. Poitevin's experiments were announced to the public.

The earlier steps of this photo-galvanographic process are similar to those adopted by the photographer on glass. My invention consists in adapting the photographic process to the purpose of obtaining a raised or sunk design on a glass or other suitable plate covered with glutinous substances, mixed with photographic materials, which design can then be copied by the electrotype process, so as to procure plates suitable for printing purposes. The operator first coats a glass plate with a gelatinous or glutinous solution, suitably prepared with chemical ingredients, sensitive to light, as follows:—One part of clear glue is soaked in about 10 parts of distilled water, but the quantity of water depends upon the strength of the glue and the state of the atmosphere. Meanwhile, there are prepared three different solutions, viz.—a very strong solution of bichromate of potass, a solution of nitrate of silver, and a weak solution of iodide of potassium. The glue is dissolved by heat, and a small quantity of it is added to each of the two solutions of silver and iodide. The remaining greater portion of the glue is kept warm, the solution of bichromate of potass added, and well mixed. After which the small portion of the glue with silver is added, and also mixed well, and allowed about ten minutes time for combining. Finally the small portion of the glue with the iodide is added, the whole mixture strained, and it is then ready to be poured on the plates of glass or other suitable material. When dry, the coated plate is ready for exposure. The photographic picture, the drawing, print, or other subject to be copied, being laid on the prepared coated surface, they are to be placed together in a photographic copying frame, and exposed to the influence of the light. After a sufficient exposure, which is exceedingly variable, according to the intensity of the light, the plate is taken out from the copying frame, when it will be found to exhibit a faint picture on the smooth surface of the sensitive coating. It is then washed with water, or a solution of borax, or of carbonate of soda, as may be necessary. The whole image comes out in relief with all its details, and, when properly done, with all its brilliancy.

If the original is a photograph, chalk, sepia, or Indian ink drawing, the copy represents the different tints in grains; if in lines, the copy will reproduce the lines.

When sufficiently developed, it must be washed with spirits of wine. The surplus moisture is removed, and the plate is covered with a mixture of copal varnish diluted with spirits of turpentine. After some time, the superfluous varnish must be removed by oil of turpentine, and the plate treated again, or immersed in a very weak solution of tannin or other astringent liquid. During this part of the process the plate must be carefully watched and removed as soon as the picture or design is considered sufficiently raised; it is then washed in water and dried. In this state the plate is ready to be copied. This may be effected by the customary methods of rendering the coating conducting, and placing it in the electrotype apparatus, producing an intaglio copper-plate; or, if first moulded, the intaglio mould furnishes the means of obtaining a relievo plate by electro-deposition in a similar way. To produce a *sunk* design on the prepared plates, I proceed as before, but after washing with the spirits of wine the plate must be dried on a warm place, and in due time the picture or design will appear sunk like an engraved plate. The printing plates are produced as before described.

If an intaglio plate is made, it may be printed from at the common copper-plate printing press; on the other hand, the relievo plate may either serve as the matrix for producing an intaglio printing plate, or it may be itself employed in "surface" printing, like a wood-cut. In the latter case, the narrow lines of the impression being sufficiently raised, the broad white spaces must be cut out on the printing plate, or built up in the matrix. The common, well-known stereotype process also affords another means of producing the necessary plate.

It is well known to practical men that any impression made by fatty ink can be transferred on stone or zinc, for the purpose of printing from it in a chemical way. This method can be also used in the present process, and there are some hopes of obtaining a good impression from the first glass plate, which can be transferred and printed.

I am unable to lay down a more exact method of treatment, as much depends on the nature of each case, the state of the atmosphere, the quality of the glue or gelatine used, &c.

Instead of the iodide of potassium, the bromide of ammonium or iodide of ammonium may be employed, as they shorten the time of exposure. In some cases the camera may be employed with great advantage, especially if the above described coating is used as a ground or basis for albumen or collodion, for the purpose of getting a picture in a shorter time, which picture is then treated like the original in the copying-frame. If required, we can expose such a plate to the influence of the light without a pressure-frame, and have the advantage that the picture or original is in immediate contact with the sensitive coating.

Although much has been done by this method, and many kinds of glue, gelatine, and similar materials, have been tried, the mode above described has been found most useful. Some improvements may be made in future, but the principles of the method are founded on a sound basis, and will experience, I think, an extensive application.

The process, too, affords the means of obtaining exact counterpart plates by the usual electrotype process, which may be used, therefore, for multiplying the plates without repeating the first process.

Thus photography may be advanced a step further, and made to become the handmaid of the graphic arts. This beautiful art is thus rendered far more practically and enduringly valuable than it has hitherto been. The impressions from the photo-galvanographic plates exhibit a tint much superior to mezzotint or aquatint, whilst whatever touches appear in nature are reproduced at the printing press with a fidelity which no artistic labour can rival, and which, in many cases, the human hand could never engrave. If an artist's original design is required to be produced, it appears in print without the alteration of a single line or touch, and on any scale.

It is well known, too, how very liable photographic originals are to change; and, in a series of copies even from the same negative, there is a constant want of uniformity in the shade of colour. With this printing process, however, we are independent of such drawbacks, as the plate impressions are in ink, and the attention of an ordinary printer suffices to keep the pictures to the proper tone.

I cannot conclude without expressing my hearty thanks for the valuable assistance which I have received in England from those gentlemen who have had a sufficient confidence in the method to form a company for carrying it out.

DISCUSSION.

Mr. **Malone** thought it would be interesting to compare some of the results of the best of the old photographic engraving processes—that of M. Fizeau—with the results of the new process now before the meeting. He exhibited some specimens lent by M. Claudet, who, with M. Fizeau, patented, about the year 1844, the method by which they were obtained. It would be seen that M. Fizeau's process furnished pictures of far greater merit than the faint designs alluded to by Herr Pretsch as characteristic of daguerreotype etchings. These plates, especially the architectural subject, showed that drawings of great vigour could be produced, comparable, he thought, with any "untouched" specimens of Herr Pretsch's new process. He then produced other prints which had been improved by the hand of the engraver, showing the applicability of the method in a variety of cases. An impression of a photographic plate of an anatomical subject, showing the complicated arrangement of a fine net-work of nerves, would bear comparison with any of the specimens by Herr Pretsch. So that, in the specimens "untouched" and "touched,"— a distinction to be carefully noted—the two processes ran in a more parallel line than the paper would lead one to believe. It was true that at first the designs were so faint that ordinary printing ink would not enter the fine grain of the etching; but by the efforts of more than one of our large London printing establishments, a suitable ink was found, which, being still of a carbonaceous character, gave a blacker impression than the plumbago mixture referred to by Herr Pretsch. He (Mr. Malone) might perhaps be allowed to remark, that, having been engaged for nearly two years in experimenting upon this process, he had had more opportunities than most persons of judging of its capabilities. The method by which the vigorous impressions he exhibited had been produced, was briefly as follows:—An ordinary daguerreotype was taken before being coated with gold, and was submitted to an acid liquid partly composed of "nitrite," not "nitrate" of potass, by which the shadows of the picture were first etched, the high lights remaining untouched; after a time, the half tints began to "bite" in, the shadows still deepening. By repeated boilings in a solution of caustic potass, the half-tints were preserved, and the whole process terminated as soon as the lights of the picture began to be etched. The plate was then inked and cleaned off as if for printing; and when dry, was coated with gold by electrotyping; the ink was then removed by potass, and the plate further etched by ordinary engraver's acid, no touching or "stopping out" being necessary, although, of course, any amount of hand skill might be exercised, if thought desirable. There were more instances than one of parallelism in the two processes. M. Fizeau, foreseeing that the wear and tear of a silver gilt plate might become costly, did what, perhaps, was tolerably obvious to those acquainted with the electrotype; he deposited copper upon the photographic etched plate, and obtained a matrix from which any number of plates, fac-similes of the original, could be obtained, the original remaining unworn, ready to supply further plates for wear and tear or accident. The plates he held in his hands were produced in the manner just described, and had been in his possession nearly twelve years, and from them the impressions before the meeting were printed. This part of the photo-galvanographic process, therefore, seemed to be a simple repetition of M. Fizeau's method. Mr. Malone begged that it might not be thought that he desired to depreciate the very beautiful process of Herr Pretsch; he wished simply that the two processes might be fairly represented to the meeting, leaving experience to point out which might be eventually adopted. Mr. Malone mentioned that he had lately seen in Paris specimens by M. Poitevin upon lithographic stone, which he could not distinguish from those on the table. He believed the processes must be nearly identical.

Herr **Pretsch** replied, that he had priority of publication, and thought M. Poitevin's attention had been directed to the subject in consequence of such publication.

Mr. **Malone** asked if he might infer, from a remark of Herr Pretsch, that most of the proofs on the table were finished by the engraver.

Herr **Pretsch** said, the graining appeared immediately by the first treatment of the plate. If anything at all was done to the plate it was merely cleaned. Some of the plates had not even been touched. Every grain and spot appeared in the first instance. The specimens in Mr. Malone's hands had not been touched at all.

Mr. MALONE observed, that it was important to bear in mind, in comparing the two processes of Fizeau and Pretsch, that some of the specimens had been touched in both instances.

Mr. M. HANHART said, the difficulties hitherto experienced in the production of photographic plates which would yield impressions in the ordinary printing press, had prevented the application of the process to the extent that was desired: Judging from the specimens Herr Pretsch had brought before the meeting to illustrate his new process, most of them being, as he asserted, impressions from copper plates that had not been touched by the engraver, he thought we might safely look forward to greater perfection in this interesting application of the art of photography. One of the specimens happened to be a reduced copy of a lithographic print well known to him (Mr. Hanhart), and he could recognise all the peculiarities of the grain, proving that the entire effect had been produced by the photographic action. He was too little acquainted with the different modes by which a somewhat similar result had been obtained on copper, to offer any remarks as to their comparative efficiency, but he would call attention to photo-lithography, of which there were some specimens on the table, by M. Lemercier. They were very interesting and promising, but still, on comparing them with the original photographic impressions, they left much to be desired. Any one acquainted with lithographic operations would make allowance for the difficulties that had to be overcome. In M. Niepce's original process the stone had to receive a coating of bitumen dissolved in sulphuric ether. When the bituminous surface was exposed to the sun's rays it became insoluble, or rather less soluble in ether. When, therefore, the surface had been acted upon by light, through the medium of a negative photograph, and was washed with ether, the parts that corresponded with or lay under the light part of the negative would remain intact, while those that lay under the dark part were washed off. This having been accomplished, the stone had to be prepared with gum and nitric acid. This, a delicate operation with an ordinary drawing on stone, became even more so in this case; the film of bitumen that remained after the washing offering so little resistance to the action of the acid on the stone, the necessary effect of the gum and acid being to change the surface, and render it incapable of retaining the grease of the printing ink. The effect of bitumen was also very different to that of lithographic chalk or ink, with which a "printable" drawing on stone had to be made. Bitumen did not combine with the stone, and therefore did not print; its action seemed to be preservative; and stearine or oleine had to be made to act upon the parts of the surface of the stone that remained covered with the bitumen, before impressions could be taken. When we considered the excessive minuteness of the silver deposit on the photographic negative, to which the printing part of the surface must correspond to produce an equally satisfactory impression as the one obtained by the photographic printing, we might readily understand why photo-lithography had not yet become so extended in its application as was to be wished. How far the ingenious method brought before the meeting that evening would realise our expectations time would show.

The CHAIRMAN said, a gentleman near him would be glad to know how many impressions could be taken from one of these plates.

Herr PRETSCH replied, from 300 to 400 copies. There was this advantage, that as the matrix was preserved, they could multiply the printing plates to any extent they pleased.

Mr. THURSTON THOMPSON remarked, that not yet having had an opportunity of making a minute inspection of the specimens before them, he was not able to form a definite opinion on the subject, but judging from what he had seen, it seemed to him that the process was complete, and the prints effective and good. There might, however, be details which would disappoint him by-and-by. He thought 300 or 400 impressions was a very small number to obtain from a plate.

The CHAIRMAN remarked, that Herr Pretsch had stated that any number of plates might be taken from one matrix. He begged to ask whether any information could be given as to comparative cost.

Herr PRETSCH replied that the chief material used, viz., gelatine, was an inexpensive article, and the same might be said of the chemicals applied to the materials. Of course, the production of plates by means of the electrotype process, would always be attended with a certain amount of expense.

Mr. MALONE inquired if galvanic agency had anything to do with the production of the image, either in improving it or otherwise, as the title of the invention might lead one to suppose.

Herr PRETSCH explained that the electrotype process was only a copyist of the gelatine plate.

Mr. MALONE thought the title was a misnomer, and remarked on the desirableness of accurate nomenclature. He stated that the only true photo-galvanographic process in existence that he knew of was that of Mr. W. R. Grove, in which the image was obtained by the action of light, and really engraved by galvanic or voltaic electricty.

Mr. CLAUDET, F.R.S., also thought, that inasmuch as electricity had nothing to do with the production of the image, the term photo-galvanography was not a proper one to apply to the process.

Herr PRETSCH remarked that so long as the results were obtained, he was indifferent by what name it was called.

The CHAIRMAN said he had invited the opinions of those present upon this subject, and he would now express an opinion himself. When specimens of these productions were laid before him some fifteen months ago, he was struck with the great ingenuity of the thing, and although he had a preconceived opinion against the success of the application of photography to engraving, at the same time he saw so much that was beautiful in this new process, that he could not but encourage Herr Pretsch to proceed with it. Since that time he (the chairman) had been absent from England, and therefore had not seen the progress which had been made in the interval, but on his return he had the opportunity of inspecting the improved productions of Herr Pretsch during the last year, and he would say, if the progress during the next twelve months was equal to that of the last fifteen, they would have to sell their photographic printing frames, and a new process would be introduced which, he believed, would supersede almost every other method of reproducing natural objects. In all the previous methods of photographic engraving, the great defect was their failure in producing flat, clear, and equal shades. In that point they all failed. Some had succeeded in producing lines, &c., with clearness, but not a flat, even, delicate shadow. Even the invention before them he considered was deficient in that respect, but it showed such signs of ultimate success that he could not but encourage the inventor to proceed with it. He thought, with the assistance of photographers and the engraver's art, it would be brought to a successful result. A few days ago he paid a visit to the establishment where this process was being carried out, and he was shown a picture upon a gelatine plate presenting only a faint impression on its surface, but when the gelatine plate was subjected to the usual process of washing in water and solutions of borax, and in alcohol, accustomed as every photographer was to the marvellous development of the photographic image, he certainly was as much struck when he saw the engraving appear in relievo as he first was with the appearances on the negative plate; from a flat surface it became at once an image in beautiful relievo. He thought the question of intaglio engraving was settled by this invention, since he could not conceive but that it would be made to produce more perfect representations than they had yet seen. With respect to another branch of the art of engraving there was greater difficulty—he alluded to surface printing. They were aware of the defects of the present mode of surface printing. Every artist who had his pictures engraved for publication in the weekly illustrated papers, suffered from the present mode of surface engraving. Even if he made his own drawing, it would require in the engraver upon wood intelligence and skill equal to his own, to convey a faithful reproduction of his work to the public mind. But by the process now before them, the artist would be independent of the engraver; he might make his own drawing, and, so far as the lines went, it would be faithfully reproduced. The only question was that of expense. The principle being admitted, he had no doubt the details would follow. He was sure they would agree with him that the best thanks, not only of the Society, but of the artistic world in general, were due to Herr Pretsch for the intelligence and perseverance he had displayed in the perfecting of this process, and he was certain they would all rejoice at the success which had been already attained.

Herr Pretsch having returned thanks,

The Secretary announced that the paper to be read on the evening of Wednesday next, the 30th instant, was "On the Printing of Fabrics, with special reference to Shawls and Carpets," by Mr. Joseph Burch.

SURPLUS FROM PATENT OFFICE FEES.

The Committee appointed by the Council to consider and report on the letter of Sir Joseph Paxton, met on Thursday, the 17th inst., at the Society's house, Sir Joseph Paxton, M.P., in the chair.

The Secretary read the following report from the Sub-Committee, appointed at the previous meeting of the Committee, "to consider the details requisite to be carried out for placing the Patent Office in a state of efficiency:"—

Report.

The sub-committee, considering the great difficulties which would attend any proposal to alter the existing law of Patents for Inventions, have confined their attention to such suggestions for the further improvement of the patent system as may be advantageously carried out without the necessity of fresh legislation. Acting under this consideration they would recommend that the following suggestions should be adopted:—

Firstly.—That the whole revenue derived from the fees paid for letters patent should be appropriated to such purposes as will promote the beneficial operation and improvement of the patent system, and encourage and aid the progress of invention.

Secondly.—That proper and suitable buildings should be provided for the offices of the Commissioners of Patents. It is at once apparent, even to the casual visitor, that the present offices are exceedingly inconvenient, and limited in their accommodation; and the Commissioners of Patents should be solicited to provide a remedy by immediately exercising the powers given by Section IV. of the Patent Law Amendment Act of 1852.

Thirdly.—That the printing of all the specifications filed previously to 1852 be completed as soon as possible, and that, where it is advisable, they should be classified in regular series.

The Commissioners, in their report of 1854, state that they purpose completing the publication of the old specifications in six years, by printing them at the rate of about 2,000 per annum; and to prepare the way for effecting this object, the surplus income from the patent fees of 1853 was carried to 1854. But there is no doubt that, by continuing to act upon the precedent of 1854, the mass of valuable information contained in the old specifications may be rendered accessible to the public at a much earlier period than the year 1860.

Fourthly.—That the library which has been opened for the use of the public in connexion with the specifications and indexes, under the act of 1852, be further extended, and that better accommodation be provided for those who visit it for the purposes of consultation.

The greater part of the works of reference which are at present in the library are merely *lent* for the use of the public, and steps should be taken for securing them as the property of the office. Numerous official publications of foreign countries, relating to patents, have been presented to the library, and these valuable series should be made as complete as possible. It may be worthy of remark, that the United States Patent Office devotes about £600 per annum to the extension and maintenance of its library of reference.

Fifthly.—That the system adopted by the Commissioners of presenting copies of their publications to all Free Libraries in this country, and of interchanging them for the official publications of foreign countries, be carried out on a most liberal scale.

In many parts of the United Kingdom Free Libraries have been established for the express purpose of receiving the Commissioners' works, so that they have been the means not only of supplying, but of creating Free Libraries. They will have it still further in their power to benefit these local libraries, if the communications which have been opened between the Patent Office and foreign governments be extended, and duplicate copies of foreign official publications be obtained, and presented to the Capitals and Chief Towns of the United Kingdom.

Sixthly.—That the system of indexing and classifying, found so efficient in the case of English Patents, be applied as far as possible to the foreign publications relative to foreign patents which have been, or hereafter may be, procured by the Patent Office, so as to afford the English inventor every facility for obtaining information respecting foreign inventions.

The close intercourse and rivalry which now exists between the leading manufacturing countries renders it necessary to ascertain the progress of invention in other countries, as well as our own. It should also be borne in mind that any description of an invention contained in a foreign publication, which is accessible to the public in England, will invalidate a patent taken out here for a similar invention. It has, therefore, become incumbent on the English patentee to extend his search, not only to prior English specifications, but to foreign ones as well.

Seventhly.—That a judiciously-selected series of models be collected, and arranged so as to mark and illustrate the progress of invention in the leading branches of art and manufacture.

It is not intended to recommend an indiscriminate or over-grown collection of models, but it is believed that the Patent Office has at its command peculiar facilities for obtaining—principally by way of gift—most valuable models, which merely require to be properly arranged and preserved to become a ready and interesting source of information to the public.

Eighthly.—That the system of registering proprietors of Letters Patent, as now adopted in the Patent Office, be rendered more simple.

It is at present the practice to register all assignments of shares or interest in a patent, in the very words of the assignment in full. This practice, besides entailing unnecessary expense, is objected to by many proprietors, who are not desirous that the exact terms of agreement between themselves and their joint owners should be made public; nor does there seem any advantage to the public in it.

Resolved—That the foregoing report be received and adopted.

Resolved—That a memorial be addressed to the Commissioners, embodying the report of the Sub-Committee; that it be laid before the Council of the Society of Arts;

and that the Council be requested to communicate with the Commissioners, and ascertain when it will be convenient for them to receive a deputation from this Committee, with the memorial they propose to present.

TRADE MUSEUM.

ANIMAL PRODUCE DEPARTMENT.

The following communications have taken place between the Royal Commissioners for the Great Exhibition of 1851 and the Society of Arts, relative to this collection :—

On the 30th of June last, a deputation from the Council waited upon the Royal Commissioners to confer with them relative to the ultimate disposal of this collection. The following extract from the Minutes of the Council shows what took place at this interview:—

Extract.

"Minute of what took place at the conference between the Royal Commissioners for the Exhibition of 1851, and a deputation from the Council, on Saturday, 30th June, 1855, relative to the Trade Museum Collection.

"Viscount Ebrington reported that a deputation, consisting of himself, Dr. Booth, Mr. Redgrave, and Mr. Saunders, had waited upon the Royal Commissioners for the Exhibition of 1851, on Saturday, 30th June, to confer with that body relative to the Trade Museum Collection.

"His Royal Highness Prince Albert, as President of the Commission, informed the Deputation that the Commissioners were fully impressed with the importance of the collection being at once placed in a situation suitable for its completion and display, and that for this purpose they had determined forthwith to erect suitable temporary buildings on the Commissioners' estate at Kensington Gore, in which this collection with other collections might be placed until the permanent building intended to be erected there should be ready for their reception.

"His Royal Highness further informed the Deputation that it would be desirable that the Council of the Society of Arts should place the Commission in possession of their views relative to the ultimate disposal of the collection, and requested to know how much longer the Council could keep the collection displayed as at present.

"It was replied that the Council could not, without very considerable inconvenience, set apart its rooms for the display of the collection longer than two months from the present time, and that under any circumstances the collection could not be shown at all in the Society's rooms for longer than three months, as the rooms, at present very inadequate for the exhibition, would be required for other purposes.

"Viscount Ebrington said, that the members of the Council present were a deputation only, and could not pledge the Council.

"The Deputation undertook to report to the Council the information afforded by the Commission, and to communicate at an early period the views of the Council relative to the proposition of the Royal Commissioners."

1.—Society of Arts to Her Majesty's Commissioners.

Society of Arts, Adelphi, London.
July 16th, 1855.

Sir,—I am directed by the Council to forward to you, for the information of the Royal Commissioners of the Exhibition of 1851, the following extract from the minutes of Council held on Wednesday last.

Extract.

"The Secretary reported that he had received the following letter from Sir Joseph Paxton:—

"'Rock Hill, Sydenham, July 6th, 1855.

"'Dear Sir,—I am called away to Paris for a few days, and as it is possible that in my absence some inquiries may be made of you relative to my proposal at the dinner on Tuesday last, I think it well to write and explain, for your information, what my proposal included.

"'On the part of the Crystal Palace Company, I should propose to give your Society ample space and every requisite facility for the exhibition of a Trade Museum at the Crystal Palace, to give free admission to the Council and Officers of the Society, and as the Museum might be placed in connection with our Raw Produce Department, to pay half the salary of a caretaker who might attend to both.

"'Our directors are all absent, and I write this on my own responsibility, but with the conviction that they will confirm the offer made by me.

"'I believe also, that should there be any difficulty in consequence of the expense to which the Society of Arts may have been put in connection with the museum, the Crystal Palace Directors would not be indisposed to assist in providing for it.

"'I am, &c.,
(Signed) "'JOSEPH PAXTON."

"Resolved,—That the Royal Commission, having a joint interest with the Society in the property of the Trade Museum, be informed of the offer with reference to it made by Sir Joseph Paxton, and asked whether the Royal Commission have any wish or opinion to express on the subject."

"Resolved,—That a Committee be appointed to take into consideration the communications which have passed between the Council and the Royal Commissioners and other parties relative to the disposal of the Trade Museum, and to report to the Council thereon."

"That the following gentlemen form the Committee:—Lord Ebrington, Mr. Macdonald, Mr. Redgrave. The Chairman and Deputy Chairman to be summoned."

I have, &c.,
P. LE NEVE FOSTER,
Edgar Bowring, Esq. *Secretary.*

2.—Society of Arts to Her Majesty's Commissioners.

Society for the Encouragement
of Arts, Manufactures, and Commerce,
Adelphi, London, July 19, 1855.

Sir,—I am directed by the Council to hand you on the other side a copy of a report of the Committee appointed to take into consideration the communications which have passed between the Council and the Royal Commissioners for the Exhibition of 1851, and other parties relative to the disposal of the Trade Museum, and I am to inform you that the report has been received and unanimously confirmed by the Council.

I am further to request that you will be good enough to bring the matter before the Royal Commissioners.

I am, &c.,
P. LE NEVE FOSTER, Secretary.
Edgar Bowring, Esq.

Copy of the Report Referred to in the Foregoing Letter.

"The Committee have considered the correspondence between the Council and the Royal Commissioners and the circumstances connected with the formation of the collection, and also the letter of Sir Joseph Paxton, and have resolved:—

"That it be recommended to the Council that the Secretary write to the Royal Commissioners, and inform them that the Council are prepared at once to transfer the collection to the Royal Commissioners, and will willingly assist in every way in their power to promote the views of the Royal Commissioners, if after consideration of all the circumstances they will,

"1st. Reimburse the Society merely the sum it will have expended in reference to the collection.

"2nd. Provide a place for its immediate reception and arrangement with a view to exhibition and its continuance as a permanent and advancing collection.

"But if the Royal Commissioners are unable to carry out this arrangement, then that the Council will, with their sanction, be prepared to make such provision as will ensure those permanent advantages which so important and novel a collection must confer on the public generally, and especially upon the manufacturing interests of the country.

"The Committee hold it their duty to recommend to the Royal Commissioners the claims of Professor Solly, who has, with great zeal, intelligence, and industry, brought the Trade Museum to its present very satisfactory position."

3.—H. M. Commissioners to the Society of Arts.

Whitehall, August 4, 1856.

Sir,—I am directed by her Majesty's Commissioners for the Exhibition of 1851 to acknowledge the receipt of your letters of the 16th and 19th ult., on the subject of the Trade Museum (Animal Produce Department) which has been formed under the joint authority and at the joint expense of the Society of Arts and the Commissioners, and which is now being exhibited at the Society's rooms.

With respect to the former of those letters, in which you transmit for the consideration of her Majesty's Commissioners, on behalf of the Council of the Society, an extract from their minutes respecting a proposal that has been made by Sir Joseph Paxton, on the part of the Crystal Palace Company, to receive and exhibit the Museum in question at the Crystal Palace on the conditions specified by him, I am to acquaint you, for the information of the Council, that the Commissioners are not prepared to become parties to the acceptance of Sir Joseph Paxton's proposal.

With regard to the proposition submitted by the Committee appointed to consider the question of the Trade Museum, and adopted by the Council of the Society, for the transfer of the whole Museum to her Majesty's Commissioners, on the conditions mentioned in the enclosure to your letter of the 19th ultimo, I am directed to state that the Commissioners are prepared to accept the transfer of the collection, and to provide a place for its reception and arrangement, with a view to exhibition and its continuance as a permanent and advancing collection, as specified in the second of the conditions in question. With reference to this subject, I am to enclose a copy of a paper that has just been laid before Parliament, containing a letter addressed by her Majesty's Commissioners to her Majesty's Government, urging the importance of immediate steps being taken to furnish, in the manner therein pointed out, proper accommodation for the exhibition of various collections of national interest for the due display of which no means at present exist.

The Council, who will be aware that the vote necessary for the purpose has just received the sanction of the House of Commons, will observe that this letter contains an especial reference to the case of the Museum now under consideration.

Her Majesty's Commissioners, in announcing their acceptance of the offer of the Society, and the admission by them of the principle involved in the first of the conditions set forth in the Committee's report, viz., that the Society should receive some reimbursement for the outlay it has incurred in connection with the formation of the Museum, would, however, observe to the Council that they had not been led to suppose, from anything that has passed between themselves and the Society, on the subject of the Museum,—either on the occasion of the recent interview between themselves and a deputation from the Council,—or in previous correspondence,—that the Society looked forward to being repaid the outlay it voluntarily undertook to incur for the promotion of a national object, so intimately connected with the immediate purposes for which the Society was founded, and as there is no expectation that any amount to be paid under this head will be advanced by the Government for the purpose, but must be defrayed out of the limited funds at the disposal of the Commissioners, they will be glad to be favoured by the Council with a statement of the sum which, under these circumstances, they may consider it right to receive on behalf of the Society in consideration of the proposed transfer of the collection.

It affords her Majesty's Commissioners much pleasure to express their entire concurrence in the remarks made in the Report of the Committee on the subject of the valuable nature of the services rendered by Professor Solly in bringing the Museum to its present satisfactory position, and their appreciation of the zeal and ability displayed by him, and of his qualifications for assisting in the further development of the collection. At the same time it appears to them that the question raised in the Report in connection with that gentleman's services is one which scarcely admits of a definite decision at the present moment, but must be reserved for ulterior consideration.

I have, &c.,
EDGAR A. BOWRING.

4.—Society of Arts to H. M. Commissioners.

Society for the Encouragement
of Arts, Manufactures, and Commerce,
Adelphi, London, 17th Oct., 1856.

Sir,—Your letter of the 4th August last, relative to the transfer of the Trade Museum now in the possession of this Society, to the Royal Commissioners, has been laid before the Council, and in reply I am directed to transmit a copy of certain resolutions which have been passed, the effect of which is formally to transfer to the Royal Commissioners the Trade Museum, as now exhibited, together with those specimens of animal, vegetable, and mineral produce which belong to the Society.

The Council, in thus relinquishing the charge of a collection, the formation of which they originated, in whose progress they have always taken a deep interest, and whose present advanced state in so short a time has more than realised their utmost expectations, believe it their duty to record their matured views as to the principles on which a Trade Museum, worthy of the vast trade and enormous commerce of this country and its colonies, ought to be developed.

The Council believe that, to form a Museum of animal produce alone, would be of comparatively little use. A Trade Museum ought to contain animal, mineral, and vegetable products, specially classified with a view to their commercial uses and technical instruction. It would in no way accomplish this object were other Museums of vegetable and mineral produce, already in existence, to be brought into juxta-position with the animal collection. The three collections thus combined would not constitute a Trade Museum; the principles of arrangement, and the classification of a collection of minerals, for example, in a Museum designed for educational or scientific purposes, are quite different from those under which the same collection would be distributed in a Trade Museum designed for commercial reference, technical teaching, and the requirements of trade.

There are some portions of your letter to which I am instructed to reply, not because the Council admit their justice, but from an anxious desire on their part to stand well with the Royal Commissioners.

It will be to them a cause of deep regret should their deputation to the Royal Commissioners be found to have in any respect gone beyond their strictly defined instructions, so as to bind, either directly or by implication, the free action of the Council. The deputation of the Council, as they are informed, stated distinctly at their interview with the Royal Commissioners that their instructions were to learn, with as much accuracy as might be, the precise views of the Royal Commissioners with respect to the future disposal of their joint property, and to report the same to the Council.

In this report (of which I annex a copy) their instructions would seem to have been rigidly adhered to.

It is quite true, as stated in your letter, that nothing has been said in the various communications which have passed between the Royal Commissioners and this Society on the subject of compensation. The question would have been premature for discussion so long as it continued undecided to whom the ownership of the Trade Museum should ultimately belong. Indeed I am warranted in saying that several members of our Council anticipated, at the time the arrangement was entered into, that the Trade Museum would be left under the control of the Council, and exhibited on premises to be appropriated to the use of the Society of Arts, at Kensington Gore.

In asking the Royal Commissioners to reimburse the Society the money actually expended by the Council on the Trade Museum they would observe, that the Society of Arts, although founded upwards of a century ago, possesses neither endowments nor real property of any kind; that although it has expended since its institution upwards of £200,000 in the promotion of national objects and in the development of the arts, manufactures and commerce of the country and of the colonies, it has never yet received the grant of one shilling of the public money, and that its whole income is derived from the annual subscriptions of its members and of the 400 Institutions associated with it.

In illustration of these statements they would call attention to the fact, that although the Great Exhibition of 1851 was mainly due to the President and Council of this Society, and they undertook all the risk of so vast and doubtful an experiment, yet they cheerfully relinquished their claim to those profits which they might have insisted on under the original contract deeds, and that although the "Surplus Fund," after paying all expenses and satisfying claims of every kind, was, notwithstanding, very large, yet no portion whatever of that fund was appropriated for the Society of Arts, even though the justice of their claim was formally recognised by the Royal Commissioners.

Again, with respect to the Educational Exhibition of last year, although it taxed the energies of the Council to the utmost, and cost £1400 besides (of which £400 remains a permanent charge on the funds of the Society), yet it was transferred by the Council to her Majesty's Government without any claim for compensation, on the sole condition that it should be forthwith exhibited to the public, a pledge which the Government have not found themselves in a position hitherto to redeem.

The Council, however, rejoice to find that this state of things is no longer to continue, for the exhibition and development of the Educational Collection made by the Society of Arts is put forward as the very first ground on which the Royal Commissioners sought and obtained a grant of public money.

Under these circumstances it is hoped that the Royal Commissioners will realize the exact position of the Council, dealing as they have to do with the small contributions of a large number of persons and Institutions, and believe that they have the strongest desire still to be permitted to afford such aid as may be in their power to uphold and promote those important national objects for the development of which the Royal Commissioners have been constituted the legitimate organ.

I am further instructed to state, that the Council learn with much satisfaction the correct appreciation the Royal Commissioners have formed of the energy, ability, and knowledge of Professor Solly. They did not, however, expect to receive a formal pledge of his future appointment. They are satisfied that his own merits will weigh more with the Royal Commissioners than even the Council's recommendation.—I have, &c.

P. LE NEVE FOSTER, Secretary.

Enclosure (1) in the above Letter.

Resolutions passed by the Council of the Society of Arts.

Resolved,—That it appears by the books of the Society that the sum of £929 5s. 9d. has been expended inactual advances solely on behalf of the Trade Museum, exclusive of the expenses due to the use of apartments, coals, gas, stationery, the services of the officers of the Society, and the attendance of its servants.

Resolved,—That the Royal Commissioners having under the arrangement originally entered into, already paid £400 towards the formation of this Museum, on their undertaking to pay to the treasurers of this Society the sum of £529 5s. 9d., being the balance of the foregoing sum £929 5s. 9d., the property of the Society of Arts in the Trade Museum be made over to the Royal Commissioners, (excepting only such articles as belong to Professor Solly,) and that the Council do present to them, as a gift, those specimens of animal, vegetable, and mineral produce which exclusively belong to the Society.

(Signed) P. LE NEVE FOSTER, Secretary.

Enclosure No. 2 in the above Letter.

Minute of what took place at the Conference between the Royal Commissioners and a Deputation from the Council, &c.—(*See ante, page* 390, *column* 1.)

5.—H.M. Commissioners to the Society of Arts.

Whitehall, October 25th, 1855.

Sir,—I am directed by her Majesty's Commissioners for the Exhibition of 1851 to acknowledge the receipt of your letter of the 17th instant, submitting for the information of the Commissioners a copy of resolutions passed by the Council of the Society of Arts to the effect that they are prepared to transfer to the Commissioners, for the sum of £529 5s. 9d., their share of the Trade Museum recently exhibited in the rooms of the Society.

Her Majesty's Commissioners observe that the above amount represents the total sum that has been expended by the Society in connection with the formation of the museum in question; but as they have already, in their letter of the 4th August last, expressed their admission of the principle that the Society should receive from them, in consideration of the transfer of the collection, some reimbursement for the outlay it has incurred in connection with the formation of the museum, and as they left it to the Council to state the amount which under the circumstances detailed in that letter they would consider it right to receive as such reimbursement, it only remains for the Commissioners to state their acceptance of the terms set forth in your communication, and their readiness to pay the full amount of £529 5s. 9d. claimed by the Society, which sum they have accordingly instructed their financial officer to pay to you on the transfer to them of the collection, and its removal to its destination in the new museum building.

Her Majesty's Commissioners direct me to convey to the Council their thanks for the valuable suggestions offered by them as to the principles upon which the development of a Trade Museum worthy of this country should be made to depend.

In thus assuming the sole charge of this collection, the Royal Commissioners cannot omit this opportunity of again testifying to the high sense entertained by them of the cordial co-operation which they have at all times experienced from the Society, whether in connection with the objects of the Great Exhibition for which the Commission was originally appointed, or, as respects the development of the more extensive scheme originating with the existence of the Surplus Fund, for the execution of which they subsequently received powers from the Crown. Of this scheme the establishment of a permanent and increasing Trade Museum forms an important part; and from their experience of the efficacious assistance which they have already received from the Society of Arts in connection with its formation, her Majesty's Commissioners will gladly avail themselves of the offer of the Council expressed in your letter, to continue to afford such aid as may be in their power towards the promotion of the national objects which they have in view.

I have, &c., EDGAR A. BOWRING.

Home Correspondence.

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IRON INDUSTRY OF FRANCE.

Sir,—It not having suited the arrangements of your Society to carry out my suggestion relative to the reading of a paper on "The Iron Industry of Great Britain, with reference to that of other countries, as regards the cost of production and transit," I have, so far as lies in my power, from the materials I have at hand, arranged some account of the iron manufactures of France, a country, next to America, the most important, as regards this branch of industry, in connection with Great Britain. The information is derived principally—I may almost say entirely, as regards France—from the Report of his Excellency the Minister of Commerce, the "*Résumé des Travaux Statistiques de l'Administration des Mines,*" in 1847, 1848, 1849, 1850, 1851, and 1852, and although the information is not brought down immediately to the present date, it nevertheless embraces a most important period, that of 1847, the year before the revolution of February, 1848, and the following years, thereby showing the effect this great event had for a time on the manufactures of France.

That the report does not come down later than 1852, is not of much consequence; the results produced show a gradual, and for the last year a decided advance, from the collapse, in the recovery of confidence, and it is still open for some one else to continue the subject from information to which I have not, at present, very ready access. I have not touched upon the nature of the minerals, nor upon the process of manufacture; these have been fully placed before your Society by Mr. Blackwell, in the paper he read—the particulars of which appeared in your journal of the 21st December and 11th January last. I treat the subject in its commercial point of view, and I have carefully avoided all French weights and money values, reducing the former to tons, and the latter to £ sterling, as more readily understood by those, who, in all probability, will feel the most interest in the information I wish to communicate.

Mines, and more particularly those of minerals connected with the manufacture of iron,—"*Ce précieux métal, qui sert tout à la fois aux œuvres de la paix et à celles de la guerre,*"—form an important part of the public riches, but as they are riches which exhaust without the power of renewal, it is most essential that the working of them should be carried out by the rules of art, so that no material should be left in the ground to waste, which it is not absolutely impossible to extract. From this motive, amongst others, the old monarchy of France considered that mines ought be classed amongst the dependencies of the royal domain—that the sovereign alone should give permission for the working of the mines. It was from this same motive that, after the abolition of the feudal rights, the mines were placed at the disposal of the nation by the law of the 28th July, 1791; and afterwards, under the Empire, by the law of the 21st April, 1810, it was declared, in accordance with the Code Napoleon, that the proprietorship of the mines was vested in the proprietorship of the land. It was, however, decided that the government had power, independent of these rights, to concede the mines to others than the proprietors of the soil, the sole condition being a quit-rent, or, as we should term it, a royalty, in favour of the latter. With the view to the proper working of the mines, the government, in making a concession, examines with the most scrupulous care, *la capacité morale, intellectuelle, et financière de ceux auxquels ils les concède, et qu'après la concession, donnée, il fait surveiller d'une manière continue, par ces ingénieurs, les opérations des concessionnaires.* Under this law 448 mines of coal had been conceded in 1847, spread over forty-five departments; of these concessions 258 were worked in 1847, which gradually increased, till in the year 1852 there were 286 mines in operation.

The following table shows the quantity of coal raised, imported, exported, and consumed, together with the average price at the mines:—

Years.	Raised.	Price.		Imported.	Exported.	Consumed.
	Tons.	s.	d.	Tons.	Tons.	Tons.
1847	5,078,850	8	1	2,511,945	52,284	7,735,620
1848	3,942,711	8	2	2,112,838	48,214	6,007,263
1849	3,990,793	8	2	2,359,406	37,146	6,313,057
1850	4,369,596	7	11	2,792,385	40,963	7,121,018
1851	4,420,320	7	9	2,884,353	34,278	7,270,391
1852	4,833,168	7	8	3,051,289	40,763	7,843,688

Of the quantity raised about one-sixth is anthracite, the average price 9s. 7d. per ton, the other descriptions of coal 7s. 8d. per ton.

The principal coal-basins are:—	Average quantity raised. Tons.
Loire	1,493,262
Valenciennes	1,025,050
Alais	342,327
Creusot and Blanzy	339,650
Aubin	144,177
Commentry	182,738
Epinac	83,182
Maine	94,221
Aix	99,881
Other basins, of which there are 53	634,802
Total annual average	4,439,240

Taking the years 1847 and 1850, the average price at the mine in 1847 was 8s. 1d. per ton, and at the place of consumption it was about 17s. 3d. per ton—more than double the cost. In 1850 it was at the mine 7s. 11d., and at the place of consumption 16s. 3d.; this reduction, though slight, is attributed to the gradual improvement in the interior communications. But in certain districts, as in half the departments of the Loire, they paid four, five, and even six times the average price at the mine.

The importation during the same period was, on the average, from

	Tons.
Belgium	1,770,094
Great Britain	579,944
Rhenish Provinces	267,398
Other Countries	1,264
Total annual average	2,618,700

As peat has a considerable consumption, it may be as well to state that the annual average quantity raised was 468,395 tons, average price 7s. 7d. per ton.

With regard to the ironstone, France is very rich in the minerals of iron, but, with some exceptions, they are found at places distant from the coal, and as the cost of the iron depends upon the price of the fuel, it is easy to understand that this is one of the principal causes why France is behind other countries, and of Great Britain in particular.

The quantity of ironstone raised in the year 1847 was 3,413,718 tons, the price at the mine being 2s. 2d. per ton. In 1848, a year of disturbance, the quantity was not taken, but it was considered to be about equal to the average of the two following years.

		Price.	
1849	1,740,913	2s.	9d.
1850	1,794,892	2	10
1851	1,748,771	2	11
1852	2,050,612	3	0

Thus, by the crisis of February, 1848, the production, and consequently the consumption of ironstone, was diminished one-half, and the mean price was raised, a natural consequence when it is considered that the preparations in 1847 "*que nous prenons pour une année normale,*" were made for a regular consumption, and when the demand decreased the general expenses necessarily increased.

The departments yielding the greatest quantity of ironstone, were Haute-Marne, Haute-Saône, Cher, Moselle, and Nord, the quantity raised being:—

		Average of each Department.
	Tons.	Tons.
1847	1,855,792	371,158
1849	960,888	192,168
1850	1,025,082	205,016
1851	945,026	189,005
1852	1,103,574	220,715

After these came the departments of Ardennes, Meuse, Côte d'Or, Pas de Calais, Nièvre, Aveyron:—

		Average of each Department.
	Tons.	Tons.
1847	805,330	134.222
1849	405,709	67,618
1850	396,958	66,160
1851	445,403	74,234
1852	572,744	95,457

Of the other departments it will not be necessary to speak, as the quantities raised were comparatively small.

In twenty-six departments they consume their own minerals, and amongst them the Nord, Meuse, and Aveyron. These appear amongst those departments in which the ironstone raised is the most abundant. But, if they do not send away their minerals it is, as regards the Nord, not only because there are many iron works, but the price of the mine is high, and will not bear the expense of long transport; a similar reason will apply to Aveyron, and here also because the means of transport are easy, and of light cost, with the departments which immediately surround it. For the Meuse, because the number of furnaces is equal to the consumption of all that is raised; and by the law of 1810 the produce of the mines is to be appropriated, in preference, to the works in the neighbourhood.

In localities where the mine is rich, and of a superior quality, and where it is raised at little cost, it is often sent to considerable distances. Thus, the mine of Haute-Marne is dispatched into three departments—those of the Côte d'Or, Meuse, and the Vosges. The mine of Haute-Saône is sent into five departments—the Côte d'Or, Doubs, Jura, Isère, and Saône-et-Loire. The Cher supplies, independent of the works in the neighbourhood, those of four departments—Allier, Indre, Nièvre, and Saône-et-Loire. The mine of the Moselle is sent to the Ardennes, Meuse, and even to Prussia. Then there are certain departments—Ardèche and Ariège, for example—which produce an iron ore of a very superior quality, so that the price is somewhat higher; this ore is supplied to many departments.

It may be remarked as regards the iron mines that, independent of 177 government concessions, which extend over thirty departments, there exist in the empire a considerable number of mines, which, in accordance with the terms of the law, are dependent on the proprietors of the land; and it is only in default of their working these mines themselves, that the government may give to the iron-masters in the neighbourhood authority to work them for the use of their works. There is a somewhat similar custom to this in the Isle of Man, with respect to the working of a quarry, which, should the working be discontinued, after it has been opened by the proprietor, may be worked by others at their own cost.

In all cases a royalty is reserved to the landlord, which, taking the year 1847, amounted to nearly one-fourth of the value of the mine raised, or about 6d. per ton—thus raising the cost to 2s. 8d. per ton. This price does not represent the value of the ironstone as ready for the furnace, because it is always mixed with earth or other extraneous matter, to get rid of which it has to be washed or calcined, and this adds considerably to the cost. Taking the year 1849, it appears that in the preparation of the mineral raised in thirty-four departments, and upon a total quantity of 1,187,636 tons,—about two-thirds of the whole quantity raised,—that it was reduced by washing to 524,964 tons, or less than half the original quantity. The operation cost about 5 per cent. on the price of the ironstone. The mineral, therefore, which has been prepared for the furnace is but 1,078,240 tons, at an average value of about 5s. per ton. This sum has still further to be raised to represent the price at the works—the cost of transport having to be added. This expense is naturally very variable, according to the distance it has to be conveyed. Upon a calculation made of these expenses in the year 1847, and adding them to the above average cost, it makes the price at the furnace about 7s. 2d. per ton.

Taking the total quantity of ironstone raised, it averages 4 tons 12 cwts. to the ton of pig iron.

From the prolonged depression which attended the revolution of 1848, and seriously affected the iron works, they are gradually recovering.

In France, the principal fuel employed in the furnaces is charcoal. The pig iron thus produced is dearer than that made with coal, but it is of better quality, and fetches a higher price. The Minister, in his Report, observes:—"*Ce mode de fabrication ouvre d'ailleurs un débouché précieux au bois de nos forêts, et il serait désirable, sous ce rapport, qu'il se maintînt, lors même qu'il serait possible aux maîtres de forges de se procurer dans de bonnes conditions tout le combustible minéral dont ils auraient besoin.*"

The following tables show the quantity of pig iron made with charcoal and with coke; also the make of bar iron with charcoal and with coal, and the average prices:—

Year.	Pig Iron Charcoal.	Price.			Pig Iron Coke.	Price.			
	Tons.	£	s.	d.	Tons.	£	s.	d.	Total Tons
1847	334,535	8	2	0	248,519	6	4	7	583,054
1848	278,258	6	5	9	187,368	5	4	3	465,626
1849	247,703	5	19	0	160,516	5	0	6	408,219
1850	226,206	5	17	10	173,592	4	14	3	399,798
1851	243,543	6	3	2	195,833	4	13	9	439,376
1852	250,540	6	11	7	265,562	5	1	0	516,102

Year.	Bar Iron Charcoal.	Price.			Bar Iron Coal.	Price.			
	Tons.	£	s.	d.	Tons.	£	s.	d.	Total Tons
1847	93,178	20	14	4	278,079	14	1	2	371,257
1848	69,896	16	6	8	202,371	12	2	5	272,267
1849	66,232	15	7	0	173,708	11	2	5	239,940
1850	67,114	14	12	4	175,529	9	19	5	242,643
1851	74,822	15	0	7	175,677	10	15	9	250,499
1852	63,670	17	3	0	233,779	10	19	0	297,449

Of the reduction of make since 1847, the most remarkable is that of the department of the Gard, which, after producing 15,057 tons of bar iron with coal in 1847, manufactured only 2,690 tons in 1849; Nord, 1847, 55,214 tons, in 1850, 22,484 tons; Saône-et-Loire, 20,204 tons, reduced to 10,053 tons; and Aveyron, 20,697 tons, to 4,628 tons.

The reduction in other districts, as Moselle and Côte d'Or, would have been still more considerable, if it had not been that, at the time of the revolution, they had large contracts for rails for the Lyons and Strasbourg railroads, which kept them employed during the crisis. Forty-seven departments manufactured pig iron with charcoal during the period under consideration, the principal of which, in the year 1847, "*la seule que l'on puisse regarder comme normale,*" were the following:—

	Tons.		Tons.
Haute-Marne	66,526	Nièvre	18,116
Côte d'Or	34,090	Meuse	16,704
Haute-Saône	33,195	Cher	16,344
Moselle	20,487	Dordogne	11,737
Ardennes	20,007		

The other departments varied from about 8,000 tons to less than 2,000 tons. In twenty-three departments, they manufactured pig iron with coke, of which the principal were:—

	Tons.		Tons.
Moselle	38,272	Cher	21,340
Nord	27,163	Ardèche	21,238
Gard	25,173	Allier	15,750
Aveyron	23,604	Pas de Calais	15,572
Saône-et-Loire	21,537	Loire	11,262

With respect to the foundries, the amount of castings from remelted iron, besides those run directly from the blast furnaces, was, in

	Tons.	Price per Ton.
1847	108,066	£15 15s. 7d.
1848	69,072	14 3 8
1849	58,680	13 10 4
1850	70,267	12 17 6
1851	81,039	12 15 7
1852	88,800	12 18 2

Another, a new and important manufacture, has yet to be noticed—that of rails. In the departments of the Nord, Aveyron, and Gard, the manufacture of rails was principally carried on in the year 1847; in the years 1848 and 1849, the Nord still held the first place; but in 1850, 1851, and 1852, the make was exceeded by that of Moselle, which, in 1847, had held only the seventh place. The price of rails was well maintained, under the influence of unexecuted contracts, till 1852, when the price fell to that of bar iron. The make of rails was, in

	Tons.	Price per Ton.
1847	87,466	£13 11s. 2d.
1848	71,784	12 8 7
1849	40,648	12 8 7
1850	22,754	12 5 2
1851	26,716	12 7 7
1852	59,590	10 17 7

The quantity of charcoal consumed in the manufacture of pig and bar iron, in the years 1847 to 1852 inclusive, was, on an average, 521,806 tons, at a cost of £2 12s. 9d. per ton.

It took 1·415, or about 1 ton 8 cwt. of charcoal to a ton of pigs, at a cost upon the ton of pigs of £4 12s. 7d. in 1847; £3 5s. 2d. in 1850; and £3 7s. 2d. in 1852. To a ton of bar iron 1·90, or 1 ton 18 cwt. at a cost of about £4 19s. to a ton of bars. The average quantity of coke to a ton of pigs was 1·85, or 1 ton 17 cwt., at a cost of 19s. 3d. per ton, or about £1 16s. per ton of pigs.

Mr. G. R. Porter in his "Statistical View of the Recent Progress and Present Amount of Mining Industry in France," (1836) of which I made considerable use in my work on the iron trade—states, that the average prices of fuel in 1836 were, for charcoal, 54s. 10d. per ton; coke, 20s. 3d. per ton; coal, 18s. 5d. per ton.

The cost of Charcoal per ton of pigs	£4 0s. 6d.
„ of Coke „	1 16 2
„ of Charcoal Pig Iron	8 10 4
„ of Coke „	4 10 4

Deducting from the value of the metal the sum expended for fuel, there would remain when charcoal is used, £4 9s. 10d. per ton; when coke is used, £2 14s. 2d. per ton.

The regular return of the make of iron in France, commenced in the year 1824. The make was, in

	Pig Iron. Tons.	Bar Iron. Tons.
1824	194,636	139,564
1836	303,739	201,691
1847	583,054	371,252
1852	515,102	297,449

Having thus endeavoured to show the progress of the manufacture in France, I will now, as briefly as possible, refer to our own manufacture as compared with that of France, keeping as closely as possible to the same periods of time.

In 1825, the make of pig iron in Great Britain was 581,367 tons; France, 195,588 tons; in 1836, France 303,739 tons.

I have not got the make of pig iron in Great Britain in the year 1836; but Mr. Mushet, in his papers on "Iron and Steel," states that in 1839, it was 1,246,781 tons; 1847, Great Britain, 1,999,608 tons; France, 583,054 tons; 1852, Great Britain, 2,701,000 tons; France, 515,102 tons.

The price of English bar iron, at the shipping ports in Wales, was, in January, 1825, £12 10s. In France, according to M. Hiron de Villefosse, £26 10s. per ton.

	Average in the year.		
1836	£10 2 6	France uncertain.	
1847	8 12 6	France—charcoal, bar	£20 14 4
		coal	14 1 2
1852	5 10 0	charcoal	17 3 0
		coal	10 19 0

France has not hitherto been a customer to any great extent for our iron, except in 1855, but of this I have not the particulars.

Our exports to France of all descriptions of iron were—

Year.	Pig Iron.	Bar and other descriptions.	Total.
	Tons.	Tons.	Tons.
1825	......	......	3,278
1836	......	......	14,422
1852	20,195	2,623	22,818
1853	31,830	3,175	35,005
1854	33,512	9,722	43,234

On the 1st of January, 1855, the New French Tariff came into operation.

Duty on pig iron	£1	15	4	per ton.
Bar, according to dimensions, from	4	8	0	
to	6	3	4	
Iron plates	8	16	0	
Steel, in bars, cast and wrought	13	4	0	
Rails, the same as bars, according to dimensions				

In 1855, the total imports into France were—

Pig iron	134,078 tons.
Bar	70,760
Together	204,838 tons.

But the returns are not yet published of the proportion of British iron included in this amount.

The general exports of British iron and steel, during the years 1853, 1854, and 1855, were—

EXPORTS.	1853.		1854.		1855.	
	Tons.	Declared value.	Tons.	Declared value.	Tons.	Declared value.
Pig Iron	333,585	£1,056,310	293,432	£1,244,853	293,584	£1,080,108
Bar and all other descriptions	907,399	9,106,979	882,448	9,747,970	786,017	7,807,604
Steel, unwrought	20,288	682,133	20,793	681,852	16,678	585,174
Tons	1,261,272	£10,845,422	1,196,673	£11,674,675	1,096,279	£9,472,886
Hardwares and Cutlery		3,665,051	....	3,868,498	....	2,960,391
Machinery and Mill Work, Steam Engines, and parts of Steam Engines		458,376	....	566,768	....	877,924
All other sorts		1,527,160	....	1,364,092	....	1,333,291
Total declared value		£16,496,009	....	£17,474,083	....	£14,644,492

Imports and Exports of Foreign Iron and Steel.

	Imports. 1853. Tons.	Imports. 1854. Tons.	Imports. 1855. Tons.	Exports. 1853. Tons.	Exports. 1854. Tons.	Exports. 1855. Tons.
Iron in bars, unwrought	47,776	41,145	37,407	5,458	4,341	3,173
Steel, unwrought	1,352	1,409	971	1,171	1,340	1,185

It is to be observed that the returns for the years 1853 and 1854, are made up to the 5th of January; those for the year 1855, to the 31st December.

The advantages we possess in our iron districts over other countries are frequently mentioned. It is said, in general terms, that our materials are all found together—the coal, the ironstone, and the limestone, which, with our clay ores, is an essential, but I do not recollect to have seen any precise description of these advantages. I shall, therefore, conclude my letter by giving some account of one of our mineral fields. The property I speak of, consisting of many hundred acres, is situated in South Wales, and the iron made at the works is of very good quality. I select a South Wales work because I consider it presents a fair medium, as regards cost, between the cheap manufacture of Scotland, and the dearer manufacture of South Staffordshire.

Sinking a pit through the minerals of this property you have, within a depth of about 160 yards,

Seven veins of coal, varying from 5 feet 6 inches in thickness to 2 feet, having an average thickness of about 4 feet. These veins have been calculated to yield 24,000 tons per acre.

Six veins of ironstone, calculated to yield 9,500 tons per acre.

At some distance below these is the limestone, which crops out about three miles from the works, and is inexhaustible in quantity.

There is also excellent fire clay.

In the following statement of the cost of the manufacture of iron, it is not my object to give a profit and loss account, but merely an approximation to an actual result:—

Coal.—Cost at the Mine.

	s.	d.
Labour per ton	3	7
Stores, pitwood, &c.	0	5
Per ton	4	0

Ironstone.—Cost at the Mine.

	s.	d.
Labour	7	2
Stores, pitwood, &c.	0	10
Per ton	8	0

Limestone.—Cost at the Rock.

	s.	d.
Labour	1	5
Stores	0	3
Per ton	1	8

Furnaces.—Cost at the Works.

	£	s.	d.
Labour	0	7	6
Coal, 3 tons 8 cwt., at 5s.	0	17	0
Ironstone, 3 tons 7 cwt., at 9s. 3d.	1	11	0
Limestone, 1 ton 2 cwt., at 2s. 6d.	0	2	9
General charges	0	2	6
Per ton of pig iron	3	0	9

Refinery.—Cost at the Works.

	£	s.	d.
Labour	0	2	9
Pig iron, 1 ton 2 cwt., 3 qrs., at £3 1s. 0d.	3	9	4
Coal, 10 cwt. 2 qrs., at 5s.	0	2	7
Per ton of refined metal	3	14	8

Puddling Forge.

	£	s.	d.
Labour	0	11	2
Refined metal, 9 cwt. 2 qrs., at £3 15s. 0d.	1	15	8
Pig iron, 11 cwt. 3 qrs., at £3 1s. 0d.	1	15	10
Coal, 1 ton 2 cwt. 2 qrs., at 5s.	0	5	8
Per ton of puddled bars	4	8	4

Rolling Mill.

	£	s.	d.
Labour	0	9	9
Puddled bars, 1 ton 2 cwt. 2 qrs., at £4 9s. 0d.	5	0	2
Coal, 1 ton 2 cwt. 2 qrs., at 5s.	0	5	8
General charges	0	5	0
Per ton of bars	6	0	7

The above costs are calculated on what is termed "Long Weight," 2,400lbs. to the ton; on this weight wages are paid, but the iron is sold at what is called "Short Weight," 2,240lbs. to the ton.

The cost of the selling weight, therefore, of pig iron, would be £2 16s. 6d. per ton, and of bars, £5 12s. 6d. per ton—to which must be added, say 5s. per ton, for conveyance to the shipping port.

The cost of manufacture, of course, varies according to the rate of wages; but these are influenced by a rise or fall in the price of iron. Our wages at the mines are calculated upon the ton. The French at their coal mines pay by the day, the average rate of which, in the whole period embraced in the report, is 1s. 8d. per day; or, taking it upon the quantity of coal raised, it amounts to double that sum; it is 3s. 4d. per ton.

The ironstone getters are employed by the year; the average amount of labour per ton of ironstone is 1s. 6d.

The great advantage the French ironmasters have, is that they are not subject to those outbreaks—*strikes*, they are called—which are too frequent in our works—outbreaks, which, although they materially affect the interests of the masters, in a still greater degree inflict a serious and lasting injury on the workmen and their families.

Yours faithfully,
HARRY SCRIVENOR.

Ramsey, Isle of Man,
April 9, 1856.

TEST OF STEEL MANUFACTURES.

Sir,—Your correspondent Mr. Wilson is a precisian. He fastens on me the *argumentum ad hominem*—defies me at "sharps"—seeks to impale me on the points of a trident. Choose from three undistinguishable blades, as Portia's lover from the three closed caskets. And if I fail to distinguish, he will pronounce me uneducated. So we must begin at the beginning—What is education?—and first, as to education in cutlery.

The agricultural mind, as exemplified in Hodge of old, purchased twelve razors for eighteen-pence. It was a lesson to him; and when his son came to the shaving age Hodge thus addressed him:—

"My son, you need a razor—a good one—a razor that will cut, and not twelve razors that will not cut. This one razor will last you a lifetime, and the cost for a good razor over a bad one is the merest possible trifle compared with the length of time, and the loss of time involved in a low-priced bad investment."

"But, father Hodge, I cannot distinguish between a good razor and a bad one."

"Then, make proof, my son. Go to the cutler and bargain for a razor on trial—sale or return. If one cutler demurs to this, set him down as a relative of the Jew who sold me you tin twelve for eighteen-pence, and go on to his neighbour, and so on until you find one willing to submit to this reasonable verification, paying him at the rate he demands. Thus, my son, you will settle one life-long business. The razor may have two defects in its quality. It may be so brittle as to break away the edge in use; or so soft as to become dull on the edge.

These are two things which you, my son, if skilful enough to shave yourself, may verify in use. If you are not skilful enough to shave yourself, you must not use personal razors, but must pay an extra price for the verification of general razors by the barber. Whatever tools you *use*, my son, you can find out the merits of in use, whether ploughshare, axe, spade, shovel, pitchfork, dung-fork, or razor; and if you have not the faculty to judge by eye or feel, be sure you never buy but by trial. Deal with the maker who will guarantee, and change them if found to fail. And so, my son, with all things you may require through life, whether shoes, shirts, clothing, or other matters. Cheshire cheese, my son, bacon, bread, beer, and provisions generally, you may verify by smell, and taste, and sight; and, to say the truth, I have ever found in you great precocity of intellect in these little matters from the time your first dream of Paradise was 'swingin' on a yett to eat fat bacon all day long;' and you trolled your happy chant—

> 'Of all the delights that are under the sun,
> Is to sit in the cellar and see the cask run,
> With a new roll and a Cheshire cheese.'

This, my son, is education. It will not make you an adept in razor-making, but it will insure you one or more good razors through your whole lifetime. And if all the boys of your school will get by heart what I have now said to you, my life on it, they will never be taken-in in razors, knives, or any other tools. If indeed they be in too great a hurry to verify it—if they think to cheat somebody by getting a knife or razor for half its value, they will infallibly be punished, as I was, my son, when, one after the other, the twelve razors pulled my beard out by the roots."

Now with regard to Mr. Wilson's three blades. I may or may not understand how to choose from them. If I do not, I shall say to Mr. Wilson, "Do you select for me, and charge me your price—not for pearl handles of price—not for Mr. Mappin's many-bladed *tour de force*—not for the tawdry adornments of bowie knives or "Arkansas toothpicks," the foppery of murder—but for an honest blade that will cut and endure."

If I do understand how to verify, I may do it for myself. I put the blade under a microscope, and if it be soft the polish will present a congeries of lines on the surface analogous to a surface of felspar that has undergone fusion without subsequent polishing. If high polish exist, and no lines but in the direction of the revolution of the polishing tool, it may, nevertheless, be too hard. If I put a cylinder of whalebone or horn into a lathe in rapid motion, and hold a brittle edge to it, it will break away; if a soft edge, it will blunt; if of the right temper and metal, it will cut. There is nothing in whalebone or horn to *grind* an edge to bluntness, and therefore a good blade should continue to cut for a considerable time. I am aware that telling this to Mr. Wilson is like "carrying coals to Newcastle." He, doubtless, can point out twenty tests, and if he would instruct customers how to apply them, the vendors of cutting rubbish would be nonplussed, as are mock jewellers by the application of strong acid to their mock gold chains. Testing all the things in common use, might surely be made a basis of common education—"knowledge of common things." It is simple laziness or ostentation that for the most part gets taken in, buying things for show and not for use.

But from the earliest times there has been occasional dubiety in Sheffield as in other wares. Historical records exist from the earliest times. In the old ballad of "Robin Hood and Guy of Gisborne"—

> "Robin pulled forth an Irish kniffe,
> And nicked his Guy in the face.
>
> * * * *
>
> Robin pulled forth an Irish kniffe,
> And losed John hand and foote."

Why *Irish* knife? Tell us that, my masters, Master Cutler inclusive! Why, but that the "Whittler of Rivelyn" was an inferior craftsman to the Shawn-a-gow who made skean or skenes for the Hernes and Gallowglasses outside the Irish Pale. Robin, jolly Robin, the King of Goodfellows, would never have left his neighbour craftsman to deal with the stranger, could he have been as well supplied at home with the tool to brittle a "hart of Greece." It was not price that influenced him, for he came easily by his coin, from bishops and others, and it could only have been quality.

Sheffield has long been famed for the fabrication of steel, but not indigenous metal. From the land of the Northmen has been brought the iron that has gained the celebrity of Sheffield. The port of Hull is the nearest haven between Swedish and Norwegian foundries and the Sheffield coal-pits. I am not aware that Sheffield was ever famed for sword cutlery, nor is there any reason save habit and custom, and the aggregation of workmen, why cutlery should be made in Sheffield in preference to Birmingham or other places. Toledo was famed of old for its marvellous sword-blades, and Andrea of Ferrara probably made his blades of Milan steel. Damascus in the East, and Solingen in the West, have been equally famous for swords of different qualities. From the earliest times perfect swords have been regarded with a kind of reverence, and feats of dexterity have been executed with them, from dividing a floating silken scarf down to the modern leg-of-mutton trick. There is probably no severer test of excellence than a thoroughly hardened, well-tempered, accurately-tempered sword-blade, and there is little doubt that at this time no country in the world produces more perfect sword-blades than England. One of the most interesting papers that could be produced would be a complete history of the sword, accompanied by specimens of all its varieties from the earliest ages down to the present date. The excellence has been caused by the demand of individuals rather than by the supply in the masses. No price could be too great for the weapon wherewith a man guarded his own life.

CHALYBS.

REMARKS ON MR. G. F. WILSON'S AND MR. HAWES'S THEORY OF SAPONIFICATION.

Sir,—I have read with considerable interest the paper of Mr. Wilson, read January 23, on Candles, and that of Mr. Hawes, of March 28, on Saponification. These gentlemen differ upon a point of great importance, viz., the origin of glycerine. Mr. Donald Campbell, in the conversation of the last evening, says:—

"As a chemist, he differed materially from Mr. Hawes in the statement with respect to glycerine—namely, that a portion of the fatty matter, during the process of saponification, was converted into this substance, and that it did not exist originally in the fatty matter employed, and he might say that all scientific experiments hitherto were against that view." The object we all have at heart is the discovery of truth; this motive alone induces me to draw upon the patience and kindness of the Society, and ask the reception of their attention to my most humble observations on the subject of glycerine.

I informed Mr. George Wilson, three years ago, when experimenting with him at his laboratory at Vauxhall, that I had reason to believe that glycerine was an artificial product, arising from new atomic molecular arrangements, produced by chemical action upon fats, oil, or grease, during saponification; whether acid or alkaline. Mr. Wilson held the contrary opinion. I wish to avoid all hypothesis, and, therefore, beg permission to state circumstances and facts, that may, perhaps, give this question a better chance of solution than any correspondence or conversation will probably obtain.

I have converted one pound of tallow, and on another occasion two pounds of palm oil, into glycerine, and will engage to do so at any time; any fatty matter from the animal or vegetable kingdom can be *wholly* converted into soluble glycerine—of course I do not undertake to operate upon Ol Ricini, or a drying oil, such as linseed oil, &c., or rosin oil. I have operated upon glycerine, made by myself, and that sold; and have converted it into retro-glycerine—that is to say, a *most perfect oil*—such as may, probably, be produced by Mons. Bertholet, but whose process I do not use. Now, sir,—suppose two soapmakers, or two candle-makers, having different processes. A shall produce, through the want of chemical knowledge, 20 per cent. of glycerine, while B, by a better process, only produces 2 or 3 per cent. of glycerine, it will be evident that the amount of stearine, or soap, produced by B will exceed that produced by A.

I have tried every means of ascertaining if there exists any affinity between pure glycerine and pure stearine and oleine, and find none to exist; in fact, a more absolute chemical repulsion of the atoms of these substances cannot be imagined—it is as north and south, in fact—then how does nature, or the divine architect of nature, unite glycerine with fats and oils? If, as Mr. Wilson stated to me, glycerine is the link, or means of union between these two different fatty matters (*i. e.* the solid and fluid parts), here is a condition or case of chemical affinity about as philosophical as the celebrated battle and its results between the two Kilkenny cats, the details of which I need not repeat. Mr. Hawes, at any rate, has done good service—he gives chemical illustration and commercial results. It is far beyond £180,000 per annum that is sacrificed to the shrine of rule of thumb; the ignorance and stupidity of some of the trade deserve the punishment they inflict upon themselves, except that, unfortunately, it falls ultimately upon the public as the consumer.

Yours, &c.

H. C. JENNINGS, M.D.

N.B.—Retro-Glycerine has most extraordinary properties, which will, probably, place it among the truly wonderful products of creative chemistry—its volume of latent heat is perfectly astonishing.

8, Great Tower-street, 14th April, 1856.

INTERNATIONAL PATENT RIGHT.

Sir,—In order to come to any clear understanding on the subject of International Patent Right, it would be necessary first to assimilate the patent laws in all countries entering into the arrangement. An inventor should then be entitled to take a patent in each country, or a protection in each country, simultaneously, being at liberty to abandon, if seeing fit. He could then negotiate in any or all. If, in the meantime, any similar specification had been lodged by a native, his right of abandoning it should revert to that person. But then comes the question, should the fact of the invention being in use in one country, disable any *bona fide* inventor from patenting in any other? I do not think it just that the first discoverer, who has patented it, or used it only in his own country, should prevent any other *bona fide* inventor from patenting and using it in any other country. It would be unjust that the foreign patentee should keep a home patentee in uncertainty for a longer period than the protection clause; and I doubt whether a patent all over the world at once would be useful to the inventor. It would be after the style of land-buying in the wilderness—a property not useful—because it would be very difficult to work. And I think it quite right to leave to our colonial governments the right of dealing each with their own patent laws. Practically, foreign patents are frequently taken and abandoned without usufruct, the patentee having no time to attend to them. But I do not agree with the governments who stipulate for a forfeiture if the patent be not put into use in two or three years; the far better plan is to keep up annual payments, for the patent is useful to the public, by the inducement it holds out to the individual to work at it, and introduce it; and an annual tax, possibly, in increasing ratio, will deter him from keeping it without use.

The fact is, that some patents are allowed to run out, because measures have not been taken to work them in time. A patent, like the "act" of the grammarians, has several branches—the invention, the provisional specification, the complete specification, the working out in practice, and the putting into business. At this time I have lying by me matured plans for many improvements in the great branches of manufacturing industry, which remain unpatented simply because I have not encountered the men with the conjoined perceptive enterprise and capital, and, I may add, good faith, essential to the promotion of my plans. In former years I advocated the giving such things gratuitously to the public, but I know by experience that, were I to publish them in your pages, the very publishing would ensure their not getting into use, because no one would put a thing into work on the terms of unfair competition. I know that they are original, for I have verified them from the patent list. I know they are valuable and useful, for they supply public wants, but they lie perdu, and will continue so to do till I find the men to supply the other side of the question, and as I have only once or twice, on a tolerably wide range of subjects, found myself forestalled, I feel, on the doctrine of averages, very little of that nervous anxiety said to be the normal condition of inventors.

At the present time some foreign governments grant privileges to English inventors of taking out patent duplicates of their English patent, at any time, but not permitting their own citizens to do the same. Abhorring the piratical principle of filching patents, still it is not for the advantage of a country that a foreigner should hold a right which he does not exercise without payment, deterring the native citizens from working at the improvement. To give three years' protection, as proposed by Mr. Tolhausen, without allowing any native subsequently to patent it, would be an evil, for no one would be interested in commencing a new process without protection. I think that French citizens are damaged by this process, although I, as a French patentee, may profit by it.

There is one obvious difficulty in internationalising. Inventors in one country cannot tell what is possibly doing in the other countries, and there would be continual clashing. It would be very hard for an English inventor, taking a patent on the 1st of May, to be told that it was void by means of a French patent for the same thing, taken April 30, and *vice versa*. Meanwhile, there is the one thing needful above all—the tribunal which shall try gratuitously the legal questions besetting patentees—the officers being paid out of the surplus Patent Funds. Till this be done—it is a mere mockery of right and justice to pretend to grant patents at all.

I am, Sir, yours faithfully,

W. BRIDGES ADAMS.

P.S.—I observe that Mr. Hawes, in his paper on Soap Manufacture, dwells upon the mischief of the exciseman stealing the secrets of a manufacturer to sell them to the trade. Mr. Hawes thus likes monopoly, with the only difference of keeping it secret, instead of making it patent; but the secret would not be appreciated by the trade if it were only a theory and not a practice. The word *theory*, in trade translation, means an impracticable or unpractised thing. Material fact is the only evidence constituting trade value; and if an inventor, not desirous of gain, wished to introduce a new plan, his best mode would probably be to communicate secretly to some unscrupulous sharp man of business his intention of patenting it and working it with some rival manufacturer. The sharp man would then, probably, put it in the patent list as "a communication from some foreigner residing abroad."

Proceedings of Institutions.

Salford.—On Friday evening, the 11th inst., the pupils of the Mechanics' Institution Day and Evening Schools were publicly examined, and a distribution of prizes took place, for which the necessary funds had been provided by Mr. E. R. Langworthy, the president, who occupied the chair on this occasion. On the platform with him were Mr. D. Chadwick, the treasurer, and Mr. Urquhart, the hon. sec. There were also on the platform about 70 boys, and between 20 and 30 girls, the subjects for examination. They were selected from the day schools, in which there are 100 boys and 30 girls, and from the evening classes, which are thus attended:—Writing, 78; arithmetic, 74; grammar, 67; drawing, 6; French, 6; mathematics, 8; singing, 6; writing, &c. (female), 25.—Mr. John Angell, the master of the boys' school, commenced the examination with a lesson on social economy, in which each question and answer formed a distinct logical step in the chain of reasoning proving a given proposition. The girls were then examined in geography and grammar, by their teacher, Miss Agnes Miller, and in arithmetic, by Mr. Chadwick. Mr. Angell further examined his boys in fractional arithmetic and grammatical analysis; and the examination concluded with a lesson on human physiology, conducted by means of a human skeleton and diagrams. The examination throughout was most satisfactory, and the intelligence and readiness of the replies elicited much approbation. The prizes were then distributed to the more deserving pupils, of whom the following is a list:—Day Schools—John Corns, William Bogg, Thomas Rowlands, James Ashton, Francis Henstock, George E. Tunncliffe; Miss Tickell, Miss E. Gilman, and Miss Brassington. Evening Classes—Grammar, John Roberts, George Teasdale; drawing, James Hamer and Alexander Braid; arithmetic, James Shephard and William Parker; writing, Richard Hulme and Thomas Foster; music, John Royle; female class, Miss Bell, Miss E. Robinson, and Miss F. Gill. A vote of thanks to the president terminated the proceedings. The directors, it is understood, entertain hopes of some of the pupils competing at the Society of Arts examinations in June next; and are, it is said, prepared to contribute towards the expenses of deserving candidates.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst., 3, Professor Huxley, "On Physiology and Comparative Anatomy."
London Inst., 7, Dr. Lankester, "On the Recent Progress of Vegetable Physiology."
Actuaries, 7, Mr. Peter Gray, "On a Theoretical Table of Mortality, proposed by the late Mr. W. Orchard."
Architects, 8, Mr. J. Clayton, "On the Bridges and Viaducts of the Present Day."
Geographical, 8½, 1. Capt. C. Irminger, "Reasons for Doubting the Existence of an Arctic Current along the East Coast of Greenland;" 2. Capt. M. Quin, R.N., "Note on the Bonin Islands;" 3. Messrs. Kelley, Kennish, Serrell, and Stone, "Reports on the Connection between the Atlantic and Pacific Oceans, *via* the Atrato River."
Tues. Zoological, 1, Anniversary.
Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Civil Engineers, 8, Discussion upon Mr. Kelley's paper, "On the Junction of the Atlantic and Pacific Oceans, by a Ship Canal through the Valley of the Atrato."
Wed. Royal Inst., 3, Prof. Tyndall, "On Light."
Society of Arts, 8, Mr. Joseph Burch, "On the Printing of Fabrics, with special reference to Shawls and Carpets."
Microscopical, 8.
Thurs. Royal Inst., 2, General Annual Meeting.
Antiquaries, 8.
Photographic, 8.
Fri. Botanical, 8.
Royal Inst., 8½, Professor Owen, "On Ruminant Animals and the Aboriginal Cattle of Britain."
Sat. Royal Inst., 3, "Dr. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 17th April, 1856.

Par. No.
93 (1). Harbours, &c.—Report of the Board of Trade.
149. Iron Ordnance—Return.
[illegible]. Committee of Selection—5th Report.
[illegible]. University of Quebec—Copy of the Charter.
98. Bill—Cambridge University (Amended).

Delivered on 18th April, 1856.

99 (7). Civil Service Estimates—Class 7.
151. Mortars—Correspondence.
157. Mortars and Guns—Copies of Agreement, &c., with Messrs. Grissell and Co.
124. Ordnance Departments, &c.—Return.
150. Disembodied Militia—Return.

Delivered on 19th and 21st April, 1856.

134. Sherburn Hospital—Copies of Correspondence, &c.
146. Cemeteries (Metropolis)—Copies of Reports.
154. Malt—Account.
161. Railway and Canal Bills Committee—2nd Report.
99. Bills—Maynooth College.
100. Bills—Lunatic Asylums (Ireland).
101. Bills—Bleaching, &c., Works.
Exhibition of 1851—3rd Report of the Commissioners.
Chancery Commission—3rd Report.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette April* 18*th*, 1856.]

Dated 21st January, 1856.

161. Gustav Adolph Blittkowski, New York—Improvements in repeating fire-arms.

Dated 23rd January, 1856.

181. Joseph Hopkinson, jun., Huddersfield—Improvements in apparatus connected with steam boilers.

Dated 24th January, 1856.

195. James Atkinson Longridge, Fludyer-street, Westminster—Improvements in the construction of ordnance and other vessels intended to resist internal pressure, and in the manufacture and method of discharging projectiles.

Dated 25th January, 1856.

201. George Gower Woodward, Kidderminster—Improvements in the manufacture of carpets.

Dated 28th January, 1856.

223. Harvey Hilliard, Glasgow—Improvements in articles of cutlery and in apparatus for sharpening and cleaning the same.

Dated 1st February, 1856.

277. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Improvements in the saponification of fatty matters. (A communication.)

Dated 2nd February, 1856.

291. George Napier, Bath-street, Glasgow—Improvements in "breaks" for railway and other carriages.

Dated 8th February, 1856.

337. Thomas Restell, New Kent-road—Improvements in breech-loading and revolving fire-arms and in cartridges.

Dated 13th February, 1856.

363. John Mills, Oldham—Improvements in the slide valves of steam engines.

Dated 21st February, 1856.

447. James Durell Greene, Craven-street, Westminster—Improvement in breech-loading fire-arms.

Dated 1st March, 1856.

525. William Crozier, Sunderland—The better extinction of fire, street watering, and other purposes.

Dated 13th March, 1856.

606. Christopher Duckworth and Thomas Marsden, Manchester—The manufacture of a new or improved woven fabric.

Dated 22nd March, 1856.

684. William Henry Barlow, Midland Railway, Derby—Improvements in covering and constructing bridges, viaducts, floors, and other structures of a like nature, when iron is used.

Dated 24th March, 1856.

693. Peter Brown and George Brown, Liverpool—Improvements in sizing and stiffening textile materials or fabrics by the application of new materials for those purposes.

Dated 28th March, 1856.

748. Samuel Getley, 6, Ivy-street, Birkenhead—Improvements in supplying and drawing water to and from cisterns.

Dated 29th March, 1856.

752. Alexander Sands, Manchester—Improvements in securing rails in railway chairs, and in the construction of railway chairs.
754. John Swyney, Massachusetts, U.S.—Improvements in breech-loading magazine fire-arms.
756. John James Rippon, Oakenshaw Print Works, near Accrington—Improvements in rollers or cylinders for printing fabrics.
758. James Eives, 17, Cornhill—A new mode of preparing fibres from plants. (A communication.)
760. Herbert Newton Penrice, Capt., R.E., Newcastle-upon-Tyne—Improvements in machinery for driving galleries through rock and other strata.
762. Charles Benjamin Normand, Havre—Improvements in steam-boilers, in apparatus for applying heat to steam-boilers, and economizing heat of furnaces.
764. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvements in steam-boilers. (A communication.)
765. Adolphe Guido, Versailles—Improvements in cleansing, washing, scouring wool and woollen fabrics and yarns.
766. Charles Durand Gardissal, 10, Bedford-street, Strand—A new compound of inflammable materials for the purpose of lighting fires in grates, stoves, furnaces, or other fire-places. (A communication.)

767. Charles Durand Gardissal, 10, Bedford-street, Strand—An improvement in screw stop-valves. (A communication.)

Dated 31st March, 1856.

769. James Hicks, Piddle Trenthide, Dorset—Improvements in stoves.

770. Benjamin Looker, jun., Kingston-upon-Thames—Improved mark or indicator to be let or fixed into the ground in burial grounds and other places.

771. Charles Jean le Mélorel de la Haichois, 39, Rue de l'Echiquier, Paris—Improvements in paving.

772. Henry Henderson, Glasgow—Improvements in stop-cocks or valves.

773. Charles Parker, Dundee—Improvements in machinery or apparatus for winding yarns or threads.

775. Thomas Waller Burrell, Fareham—Improvements in machinery for obtaining power by water. (A communication.)

776. Henry Cornforth, Birmingham—Improved manufacture of plated tea-pots and coffee-pots, and other vessels and articles of like manufacture.

777. Alexander Prince, 4, Trafalgar-square—Improvements in steel pens, for regulating the elasticity thereof. (A communication.)

778. George Thomas Smith, Northampton, and Joel Watts, Battersea—Improved lubricator.

779. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for folding paper. (A communication.)

Dated 1st April, 1856.

780. Joseph Bentley, Liverpool—Improvements in breech-loading fire-arms, and in the cartridges to be used therewith.

781. Charles Baptiste, Toulouse (France)—Improvements in machines for manufacturing tenons and mortices. (Partly a communication.)

782. James Ashton, Hyde Corn Mills, Hyde—Improvements in machinery or apparatus for bruising or breaking grain or other matters preparatory to grinding.

783. Alfred Southam, Samuel Stead, and James Martin, Manchester—Separating or recovering the vegetable substances from mixed fabrics, and rendering the same vegetable substances again available for manufacturing purposes.

784. Armand Louis André Herbelot, Paris—A new method of obtaining a continual motive power.

785. Etienne Laporte, Paris—The application of certain new materials in the manufacture of bougies, candles, and other similar articles.

786. John Gray, Peckham—Improvements in steam-boilers, furnaces, and fire-bars.

787. Alfred Vincent Newton, 66, Chancery-lane—Improved apparatus for ascertaining gradients. (A communication.)

788. William Roberts, Millwall, Poplar—Improvements in the construction of pumps.

789. John Paterson, Linlithgow—Improvements in the manufacture of paper.

Dated 2nd April, 1856.

790. Frederic Grice, West Bromwich—Improved machinery for the manufacture of bolts, rivets, spikes, screw blanks, and nuts.

792. Richard Roberts, Manchester—Improvements in omnibuses and other passenger carriages.

793. Peter M'Gregor, Falcon Works, Manchester, and Thomas Marquis, Huncoat, near Accrington—Improvements in the machines for spinning called "throstles."

794. James Smith Cottrill, Great Lever, near Bolton—Improvements in presses.

795. Charles Ellis, Stockport—Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances.

796. George Bell Galloway, 42, Basinghall-street—Improvements in propelling vessels.

797. Ledowiska Bonnard, Tottenham Court-road—Improvements in collapsible or folding hats and bonnets, and in flexible articles to be applied to other coverings for the head. (A communication.)

798. George Gwynne, Trafalgar-square—Improvements in treating fatty, oily, and greasy bodies.

799. Henry George Hine, Brecknock-street, Camden-town—Improvements in children's and invalids' carriages, called "perambulators."

800. Henry Smith, Lee—Apparatus for cleaning and polishing boots and shoes.

801. James Samuel, Great George-street, Westminster, and John Nicholson, Bow—Improvements in steam and other vapour engines.

802. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the construction of rotary steam-engines, applicable in part to pumps for raising and forcing fluids. (A communication.)

Dated 3rd April, 1856.

803. William Jenkins, Neath Abbey—Improved method of manufacturing copper rollers for calico printing.

804. Edmund Alfred Pontifex, Shoe-lane, and William Needham, Vauxhall—Improvements in the manufacture of preparations or primings used for preparing canvass, wood, or other material for the reception of pigments or colours.

805. Charles Colonel Smith, Wolverhampton—Improved method of working brakes for stopping machinery used for raising coals and minerals, and for stopping steam-engines and other motive power engines.

806. William Billinton, Great George-street, Westminster—Improvements in strengthening and preserving wood and timber.

807. Henry Robert Abraham, Essex-house, Barnes—Improvements in passenger, exhibition, or delivery tickets or checks, and in the method of indicating and recording passenger traffic, or delivery of goods, and in the machines used as tell-tales for such purposes.

808. Thomas White, jun., Portsmouth—Improvements in slips and ways for receiving ships or vessels requiring repair, and for apparatus to be used for hauling up ships or vessels.

809. Frederick William Kitson, Leeds—Improvements in the manufacture of railway wheels.

810. John Hamilton Glassford, Glasgow—Improvements in the production or preparation of printing surfaces.

811. James Bannehr, Exeter—Improvement in manufacturing or preparing paper for, and in mounting copies of, written documents thereon.

812. John Fernie, Forrester-street, Derby—Improvements in hoists by combining steam and a hydraulic column.

Dated 4th April, 1856.

813. Paul Emile Chappuis, 69, Fleet-street—Improvements in looking glasses to render them double-reflective.

814. Robert Halliwell, Bolton-le-Moors—Improvements in the machines for spinning called "self-acting mules." (A communication.)

815. Charles Durand Gardissal, 10, Bedford-street, Strand—The treatment or preparation of fabrics or textile materials to be dyed or printed. (A communication.)

816. Samuel Fisher, Birmingham—Improvements in the manufacture of anchors, shafting for mill and engine purposes, axles, cranks, and spindles, and in the furnaces or muffles used in the said manufacture.

817. John Roberts, Upnor, Kent—Improvements in the manufacture of ornamental tiles.

818. Charles William Ramié, 73, Denbigh-street, Pimlico—Improvements in constructing the permanent ways of railways.

819. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in moulding planes. (A communication.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

862. Peter Bancroft, Edmund-street, Liverpool, and Stephen White, Bond-street, Liverpool—A method of manufacturing certain oils or oily substances obtained from the petroleum, commonly called earth oil, found in certain districts of the Birman empire and elsewhere.—10th April, 1856.

868. Lewis Normandy, 67, Judd-street, Brunswick-square—Improvements in the mode of writing and printing music to facilitate the study thereof.—11th April, 1856.

900. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in surface or fresh water condensers, chiefly applicable to steam-engines.—15th April, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed April 18th, 1856.

1765. John Benjamin Daines.
2339. John Cheesman Wagstaff.
2344. William Smith.
2352. Pierre Antoine Henry Parant.
2355. Frederic Whitaker.
2360. Alexander McGlashan and Edward Field.
2361. Charles Lenny.
2410. Joseph Whitworth.
2419. William Naylor.
2426. Thomas Webster Rammell.
2487. Richard Archibald Brooman.
2532. Alfred Vincent Newton.
2582. Charles Crum and Charles Paul.
2614. William Harvey.
2630. Alexandre Tolhausen.
2672. Edward Peyton and Duncan Morrison.
2826. George Tomlinson Bousfield.
2828. Edward Orange Wildman Whitehouse.
2839. William Clay.
2894. James Murdoch.
2923. Thomas Duppa Duppa.
38. George Tomlinson Bousfield.
117. John Hamilton, jun.
119. John Hamilton, jun.
273. Edward Schischkar.
294. William Goodman.
350. Louis Schwartzkopf.
364. William Horatio Harfield.
384. William Hamond Bartholomew.
470. Henry Loveridge.
484. Edward Slaughter.

Sealed April 22nd, 1856.

2369. John Bellamy.
2378. John Healey, John Foster, and John Lowe.
2383. Charles Crickmay and Frederick Joseph Clowes.
2385. Eugène Hippolyte Rascol.
2387. Henry Tritton.
2389. James Platt and John Whitehead.
2393. John Pinches.
2397. Edward Stark.
2408. George Riley.
2467. William Prior Sharp and William Weild.
2475. Arthur Dobson.
2483. George Baring Locke.
2495. Edward Jeffreys.
2521. John Raywood.
2525. William Henry Walenn.
2687. Richard Archibald Brooman.
171. Joseph Francis.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

April 14th.

898. Moses Robinson.
906. John Wallace Duncan.
916. George Titterton.

April 15th.

935. William Fawcett and Francis Best Fawcett.
938. François George Sicardo.
1201. Peter Armand le Comte de Fontainemoreau.

April 17th.

943. Frederick Henry Smith.
957. Sir William Snow Harris.
960. Charles Reeves, jun.
964. Philip Harris, Lieut., R.M.

April 19th.

959. Thomas Dunn.
981. Henry Houldsworth.
983. William Johnson.
1010. John Hetherington, John Dugdale, and Ed. Dugdale.

Journal of the Society of Arts.

FRIDAY, MAY 2, 1856.

TWENTIETH ORDINARY MEETING.

Wednesday, April 30, 1856.

The Twentieth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 30th inst., A. Salomons, Esq., in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Carr, Anthony.
Drury, Mark Henry.
Fowler, Robert Nicholas.
Henley, Thomas L.
Sandon, Lord Viscount.
Simons, George.
Stenhouse, John, LL.D., F.R.S.

The paper read was—

ON THE PRINTING OF FABRICS, WITH SPECIAL REFERENCE TO SHAWLS AND CARPETS.

By Joseph Burch.

Into the origin and practice of the art of calico printing in ancient times it is not my province to enter. Indeed, the materials for that purpose are too scanty to afford any definite or reliable basis on which to build up a history of the art. I may, however, mention that, in India, the art of calico printing appears to have been practised from time immemorial with considerable success.

The large cotton pallampoors, or chintz counterpanes, manufactured in the East Indies, were first painted by the brush, with dye-absorbing mordants; the colours were then raised, and the material was afterwards dyed blue with indigo, the design being protected by a covering of soft wax, which was also applied with a pencil, and was easily cleaned off, after the dyeing process, by washing.

With the permission of the meeting, I will give a short extract from Pliny, because it has a bearing on some of the modern processes which I shall refer to in a subsequent part of my paper:—"Robes and white veils are painted in a very wonderful way; they are first imbued, not with colours, but with dye-absorbing drugs, by which afterwards, though they seem to be unaltered, yet, when immersed in a boiling cauldron for a specified time, they are found to become painted. Yet it is very marvellous that, from one colour only in the cauldron, many should appear on the robe, in consequence of the absorbing influence of the drug; yet from it the cloth acquires different colours of a permanent nature, which cannot afterwards be removed by any process of washing. The colours of cloths prepared in this manner are always more durable than if they were not dipped in the boiling cauldron, which, although it would of itself appear merely to confuse the colours of cloths previously dyed, is thus made to impart several distinct colours from one dye-stuff, the painting process successfully proceeding while the cauldron boils."

Before going any further, it perhaps will be as well to clear up this mystery of Pliny's, by explaining that the dye-absorbing drugs which he mentions are now known as the mordants, and that, according to the chemical nature of the mordants, so the colouring matter of madder is varied. Thus blacks, and the intermediate tints of purples to lilacs, are produced from acetate of iron mordants of various strengths; dark reds, pale reds, and pinks, are produced from acetate of alum; and a mixture of the two mordants produces chocolate colours. Therefore, if a piece of calico be printed with these mordants in strengths differing in proportion to the varying shades of the design, so the colours will appear thereon as they are gradually raised in the madder beck, or cauldron, which contains madder dye.

Augsburg became celebrated for its prints about the close of the seventeenth century, and from that city the art migrated to Alsace and Switzerland. Into England, where, by the aid of mechanical and chemical science combined, the greatest development of the art was destined to take place, it did not find its way until about the year 1690, when a small print factory was established on the banks of the Thames, near Richmond, by a Frenchman, whom some writers suppose to have been a refugee, after the Revocation of the Edict of Nantes. The success of the first attempt, which was materially advanced and encouraged by the prohibitory legislative enactment against the importation of the Indian chintzes, soon aroused a spirit of enterprise, and a more extensive concern was established at Bromley Hall, on the Lea, and as the demand for these productions increased, similar establishments were erected on the banks of the Wandle and other streams in the suburban districts of London, a supply of pure water being indispensable for carrying on the process. Here this newly-imported art took root, and flourished, and it was confined to this locality for upwards of half-a-century, London being the principal market for the sale of the new manufacture.

The prohibition against the importation of the Indian chintz did not extend to the white linen cloth, which continued to be admitted into this country on payment of a duty. It was an expensive but very durable material, manufactured from fine flax, and has been sold, when printed, at upwards of a guinea per yard, half that price being paid by the merchant to the printer for printing it. While the demand continued to exceed the supply, but few attempts were made to cheapen the process, the most elaborate chintz styles being generally finished with the brush, by young females, called pencillers, who afterwards dotted upon the cloth those colours which could not be obtained from the madder dye.

At this period of calico-printing the process was performed, and the effects produced, from wood engraved blocks, which art, as applied to calico-printing, had then reached perfection. Box-wood was used for the outlines, which were in reality works of art, often requiring, perhaps, three or four months for the completion of a single block. Specimens of these blocks are still preserved, most elaborately and beautifully cut, the perfection of which in the present day the work-people cannot rival, as this expensive process has been superseded by less costly methods. Single coloured designs on cloth were also produced soon afterwards, by a machine, from flat engraved copper-plates, and also by a surface roller printing machine, called a "Snivy;" and, in the absence of a more refined method, at this time a very simple contrivance was adopted for printing stripes. It consisted in the use of a wooden trough, with a thin metal bottom, which was perforated with holes at certain distances apart, corresponding in size and regularity with the stripes in the design to be produced. This trough was pressed parallel with its axis on a wooden drum, covered with a soft material, and made to revolve by means of a handle. The calico, after being carefully rolled upon a beam, was placed on bearers in front, and the end introduced between the drum and trough, before the thickened colouring matter was poured into it, which soon found its way through the holes in the metal plates to the calico, but did not spread, in consequence of the pressure. When, however, the drum was made to rotate, the calico was drawn along, causing the colour to stream out and form the striped effect. Very perfect work was produced in this manner, but generally in light shades of colour. Sometimes the trough was divided into compartments, which enabled the printer to make several colours on the cloth at one operation.

The Excise duties then levied on calico prints materially retarded the development of the trade, which afterwards migrated to Lancashire and Scotland. The improvement, however, in spinning and weaving cotton, with the introduction of the cylinder machine for printing with engraved rollers, the invention of Mr. Bell, a Scotchman, who first brought it into operation in Lancashire, soon established a new era in the history of calico printing. As these changes materially cheapened the process, competition began to weigh heavily on the London printers, who, in self-defence, were obliged to reduce the wages of their workpeople, and this led to frequent quarrels and turn-outs. The struggle with the country producers lasted some years, and was the primary cause of the decay of the London trade, eventually leading to the gradual disappearance of those printing establishments, which, with few exceptions, have either been removed or appropriated to other manufacturing purposes. The printing of silk handkerchiefs, however, has still its chief seat in the neighbourhood of London. The price of labour having approximated to the wages in the north, the printers of silk handkerchiefs are enabled to struggle successfully against their country competitors, and although many attempts have been made to absorb this trade also, both parties being equally affected as regards the elements of cost, they have, with one or two exceptions, failed.

Although blocks are still used for some simple processes, very great facilities have been given to the production of the more elaborate styles by the introduction of Mr. Applegath's ingenious machine for printing silk handkerchiefs from flat engraved plates. This machine is now in general use for several descriptions of work, particularly madder dyes. He has also invented a beautiful little machine for printing the borders on silk handkerchiefs, called the wheelbarrow machine, from its being worked by the hand round the cloth, which remains stationary. The silk handkerchief trade is also indebted to this gentleman for many other mechanical appliances and inventions, and the improvements in the styles of design may, to some extent, be attributed to his enterprising and encouraging system. Improvements, however, in the different processes, are but trifling as compared with other branches of the trade. The black and red, or madder style, is still performed in the manner described by Pliny; and wax, warmed to a liquid state, is also now generally used to preserve white objects during the operation of dyeing, the wax being afterwards removed by boiling in soap.

The old method of engraving blocks on box-wood for calico printing, was superseded, about seventy years ago, by the process called "coppering," the invention of an Englishman, named Service. This new mode had the advantage of being more expeditious in its execution, more economical in cost, and capable of more delicate detail, besides possessing none of the disadvantages of a wood engraved block, after it has been worn by use. In order to strengthen the objects left in relief upon the printing surface, it was necessary to give them, particularly fine lines and forms, a strong foundation, and for this purpose the incisions with the cutting knife on each side of the design were made in an outward slanting direction, thereby strengthening the minute tracery of the design, and protecting it against the ordinary risk of breakage from carelessness and accident, to which, while in use, these blocks were continually exposed. In proportion, therefore, as the surface became worn, a coarser impression would be given, and in order to restore its original fineness, the expensive process of paring the sides of the objects had frequently to be resorted to. By the new method this objection was entirely obviated. It consisted in forming the figures on the surface of the blocks with pieces of thin sheet metal, which were carved and filed to the fashion and form of the design as traced upon the surface of the block. These pieces of metal were driven into the wood by blows from a light hammer, an incision to receive them being first made by a fine-cutting tool through the traced lines of the design. Their upper surfaces, which, in a finished block, represented the design raised in relief, were, by filing and grinding on a fine-cutting stone, reduced to the true horizontal plane necessary for the production of equal even work. These strips and bits of metal, being of a uniform thickness, did not by wearing increase or vary in the impression they gave; and as by this plan very delicate minute lines and objects could be represented, it was generally adopted by the trade, and the old method for the outline blocks discontinued, except in very coarse work, such as is now in use for printing paper-hangings. The grounding-blocks, however, are still cut or engraved after the old fashion.

As one improvement treads upon another and supersedes its predecessor, so Service's invention was destined, about fifteen years ago, to be put aside by a system of casting printing surfaces in type metal. This plan, although for years rudely practised here and elsewhere, was really first brought to perfection in France and thence introduced into this country. The moulds used for the purpose are made of lime wood, which, in consequence of its tough fibrous nature, is found to be superior to any other description of wood. Service's method of introducing the copper pieces to form the design was continued. The wood used is in square blocks, the surface acted upon being across the grain. On this the design is drawn, without any repeating parts; the pieces of copper, which are about a quarter of an inch wide, are then driven edgeways about one-half their breadth into the wood, in the direction of the grain, to a uniform depth, leaving a portion projecting therefrom, similar in appearance to the old coppered block, but not for the same purpose. Heated metal is then poured upon the projecting pieces of copper, where it remains till cool, and by the natural contraction of the liquid metal, the copper pieces soon become firmly imbedded in it. The heat of the metal being taken up by the pieces of copper, has the effect of loosening them in the wood by slightly contracting the surrounding parts. When the whole is cool, the coppers are found firmly united to the metal, and are easily drawn out of the wood, leaving open spaces in the block, forming the mould, from which many castings in type metal can afterwards be obtained without injury. The only care required in the process is to attend to the size of the castings, which would be affected by the shrinking of the mould if used too quickly after the withdrawal of each casting. The wood must be allowed a sufficient time to cool. When any contraction of the mould occurs, it is easily restored to its original size by placing it in a moist atmosphere. The advantage of this plan over the old system was a saving of the cost of every repetition of the design upon the block or nearly so, which could thus also be increased in size.

This mode of making moulds has been superseded by the introduction of my mould-punching machine, by the use of which still further economy, not only in time, but in cost, has been effected, the calico printer being enabled to cast not only the prints but many of the grounds. This improvement dispenses with the necessity of fashioning fresh pieces of copper for each new mould; the interstices in the wood being made with small steel punches, by the combined action of heat and pressure, the most minute work can be produced. It is general in its application to the details of all designs, which are now executed by it with a degree of simplicity and accuracy unknown in the making of surface blocks. The small steel punches are fixed in the ends of vertical metal heaters, which are constantly exposed to the flames of gas or burning charcoal, and these communicate heat to the steel punches. The lime wood block is placed with the design drawn upon its upper surface, on a table beneath the heated punches, which are then, by means of a treadle, pressed upon by the workman's foot, brought to bear individually upon the details of the design, and by degrees made to punch and burn out the pattern. As it was necessary that in order to see the progress of the work the workman's face should be very near the heaters, great inconvenience was felt from the heat, which at last I remedied by the use of a thin surrounding chamber or shield, through which a stream of cold water was introduced, thereby removing the annoyance which threatened to be fatal to the invention in consequence of the workmen declining to use it. This invention (the punching machine) is now in general use, particularly in Scotland, where block printing has been driven, by the high price of labour in the southern parts of the United Kingdom, and where hand-printing may be considered to have taken its last stand.

For the purpose of encouraging the method of surface roller printing, I have lately introduced an apparatus for bending the cast plates, which can be accomplished with the greatest exactness, and without injury to the objects in relief, which are curved at the same time. This is effected by the use of a roller placed concentrically in a semi-circular trough of such an increased radius as to leave a space between the two corresponding with the thickness of the plate including the objects in relief. The plate is introduced between the roller and a thin elastic sheet of steel attached to the roller, which enters with the plate at the same speed, bearing externally against the semi-circular trough where the friction takes place. My attention was directed to this improvement, in order to encourage the use of the punching machine, and the adaptation of cast plates to surface roller printing, so as to bring into general use a machine which I had invented and patented in 1849, and which is now successfully applied to the printing of shawls in the neighbourhood of Glasgow.

Shawl printing had not hitherto been regarded as a very important branch of the print trade. Until within the last few years, it was chiefly confined to the production of simple styles and low qualities. The red woollen shawls printed with black designs in borders and centres were much in fashion about forty years ago, and imitations in Turkey red dyed cottons were then extensively manufactured. Attempts were made to introduce chintz styles upon white and light coloured grounds; but from the want of taste in the designs, and the coarse vulgar appearance of the printing, they had an unpleasing effect. Although from time to time the attempt was repeated, printed shawls were generally rejected by the public. Some good subdued effects were obtained by printing the warp before weaving, and shawls thus printed were sold for a few seasons. Latterly, however, the printed shawl trade has received a great impetus, since the introduction of the cheaper process of block-making, to which circumstance alone may be attributed its gradual and increasing importance. The patterns which were formerly of an ordinary class, are now good imitations of the most elaborate cashmere designs. The perfection at which they have arrived, and facility with which they are now printed, have established them as regular articles of commerce.

Many printing establishments in Scotland are now employed entirely in the production of shawls, engaging, probably, more special talent in design than any other style of work. The best and richest goods have been printed by Mr. Swaisland of Crayford, Kent, who has succeeded in producing some of the finest specimens of printing ever seen either in this or any other country. Some of these patterns exhibiting the most tasteful chintz and cashmere designs, require more than a hundred blocks to produce them in full detail. The expense of this, even with the cheapened process of block-making, amounts to a large sum. These goods have been well imitated by the Scotch printers, who, by the aid of the punching machine, now print exact imitations of the richest cashmere styles, produced by hand labour, at a very moderate expense. It is now a greatly increasing trade, both in the home and export markets. The material used is a mixture of wool and cotton, or silk; the colours used are topical, that is, mixed with their mordants before being applied to the cloth, and fixed afterwards by exposure to steam. These colours on wools are permanent, and are now frequently applied by surface rollers. The designs for Cashmere shawls, and imitations of ornamental woven fabrics, are generally composed of minute bars and small pieces of outline, in order to represent as nearly as possible the distinct coloured threads in the weaving. It is necessary when these outlines are printed that they be well dried, before the flat or ground colours are introduced, which would otherwise overwhelm their tiny shapes, and destroy the beauty of the design, which mainly depends on the careful preservation of the outline.

Real perfection in printing by machinery was lost in consequence of the colours following each other so rapidly when wet, a fault which had always given to hand-printed fabrics, such as mousselines-de-laine, &c., a decided preference, as in that slow process the first colours have time to dry before those following are applied. For the purpose of remedying this defect, and so removing the only existing objection to machine printing, I invented a machine which enables printers to produce designs on mixed fabrics in every respect equal to the best productions by hand. For this purpose I employ a drum, of such dimensions that the piece of tissue shall be entirely exposed and fixed round it without the ends overlapping, which are secured in a longitudinal groove left for this purpose. This magnum drum, which is sufficiently long to accommodate several pieces at the same time exposed on its surface, side by side, has on its periphery at one end a ring of carefully adjusted cogs, and attached to the ends of the shafts which actuate the printing rollers are small toothed wheels, corresponding exactly in their diameters with the printing rollers. These are made to work into the ring of cogs, the number of which is an exact multiple of the teeth in the small wheels, so that as often as the drum revolves, the same teeth in the drum and wheels always work together. The usual methods of furnishing the colour to surface rollers were introduced, and the arrangements in that respect were similar to those in ordinary use. The piece being carefully and tightly spread on the drum, remains fixed until all the colours are applied, which is done by the rollers separately, time being allowed for each impression to dry before the next is applied. As the drum is made to accommodate several pieces side by side, the object is effected without any loss of time. One workman at these machines can print as much as ten hand printers. The quality of the printings, as regards the register of the colours, is infinitely superior. Some specimens shown at the French Exhibition were much admired by the jurors. Some useful improvements in the application of short surface rollers, and the mode of applying them, were invented by Mr. James Melville, of the Roebank Print Works, who has united his interest with mine in the invention, which may now be considered a perfect substitute for hand labour.

As regards the many processes now in use for producing the various styles of the present day, it is not my purpose to particularise or describe them; the limits of this paper will not admit of it. Many works treating upon the various processes have been published, amongst which I may mention Dr. Ure's "Dictionary of Arts and Manufactures;" Parnell's "Treatise on Calico Printing;" "The Encyclopædia of Useful Arts;" Professor Persoz's elaborate work on the subject, and Dr. Muspratt's chemical work now issuing from the press. The Philosophical Society of Manchester, has taken up the subject, and a complete history of calico printing will be brought out under its authority. The different sections have been undertaken by gentlemen of well-known experience, and great mechanical, chemical, and artistic skill. The names of Dr. Smith, Messrs. Bennet Woodcroft, E. Schunck, John Graham, and Joseph Locket, are associated with it, in themselves a sufficient guarantee that a valuable work will be produced.

Printing from engraved rollers by the cylinder machine has, in consequence of the great speed with which they deliver their impressions, become the ordinary method for producing cotton prints; and although many block printing machines have been invented, all more or less successful in their application to the peculiar purposes and styles for which they were intended, the cylinder has maintained the preference, and for calico-printing purposes is now almost the only machine employed. The great expense, however, of engraving the copper rollers operated for a considerable time against their general introduction, as most of the engraving was wrought by skilled hand labour. It was not until after the introduction from America of the invention of Mr. Jacob Perkins for transferring and multiplying repetitions of designs of engravings by means of steel dies, that the cheapening of the process enabled the printers to make general use of the cylinder printing machine. Many improvements have from time to time been made on the original cylinder printing machine; from the use of one or two rollers, the number was increased to five and six, and latterly eight, ten, and twelve-coloured machines have been contrived and worked with considerable success.

Most manufacturing processes have, however, some practical difficulties or objections to contend with; one great practical difficulty in printing chintz patterns with many colours from engraved rollers has always existed, and still remains—it is the impoverishing effect which the pressure of the plain surface portions of the engraved rollers are found to produce upon the impressions which precede them in the machine, causing a very serious deterioration of the colour, which is thus taken from the surface of the cloth, where its brilliancy is most required. The existence of this hitherto irremediable objection is admitted by all; the effect of it upon the cloth and colour may be compared to the difference in the colour of common writing, where blotting-paper has been used, and where the ink has had time to dry without its use. In the operation of the cylinder machine a similar effect is produced by the immediate application of one engraved roller after another; the impression of the first roller is thus deprived of a portion of its colour by the pressure thereon of the plain surface of the second roller; the third roller increases this defect on the first, and robs the second; and so on, each succeeding roller helping to destroy the intensity of the colour already deposited. This objection is not so serious where mordants are employed, as they immediately attach themselves to, and are absorbed by, the fibres; even these are frequently reduced to a threadbare appearance, the impressions of the first working rollers being easily distinguished by practised eyes. To obviate this difficulty in many colour machines, the combined use of both engraved and surface rollers has been introduced in the same machine, a series of engraved rollers first giving their impressions, followed by a number of surface rollers round the same drum, to work out the effect of the many colours required to perfect chintz designs.

This defect, however, in the principle of the cylinder machine, is not very detrimental in the general production, and excepting (as already stated) in full chintz styles and superior qualities, the increased value of which entirely depend on the purity and distinctness of their colourings, it is thought to be of but slight importance. The rapidity with which this really beautiful machine turns off, with unerring exactness, piece after piece, its miles of printing per day, is truly wonderful. Although it cannot accomplish the fancy styles of topical printing with that perfection which surface printing effects, yet to the cylinder alone is due the extraordinary cheapness of cotton prints.

Engraved rollers and this machine were first applied to the printing of cotton handkerchiefs by Messrs. Todd and Higginbotham, of Glasgow, whose daily productions at the present time amount to 6,000 dozens per day. Many printers print from 15,000 to 20,000 pieces weekly by the cylinder machine, and the stock of copper rollers required in large establishments, independent of the engravings upon them, is of the value of from fifteen to twenty thousand pounds.

In the year 1846, Mr. Bennet Woodcroft's pneumatic process of printing deoxydised indigo in an artificial atmosphere—an invention which ranks amongst the greatest achievements of chemical science as applied to calico printing—was successfully applied to the cylinder machine by Messrs. Hoyle and Co., of Manchester. It is known that in a gas, such as common coal gas, or in any atmosphere devoid of free oxygen, the deoxydised indigo will remain liquid for a length of time, and only while in this state is capable of being absorbed by the cotton fibre, for as soon as the indigo takes up oxygen, it assumes the blue colour, and becomes insoluble. In order to preserve it in a liquid state after its application to the cloth, Mr. Woodcroft contrived a chamber, filled with coal gas, into which the cloth was passed at once from the machine, and where it remained until the indigo was absorbed. During its movement through the chamber the indigo, remaining liquid, was entirely absorbed by the capillary tubes of the fibre, and thus a depth of shade almost approaching to a black was produced from a colour which, if printed in the ordinary way, would have been little more than an azure blue. The process, too, was completed in much less time than that required for the process ordinarily in use.

Mr. Woodcroft's invention for printing yarns from engraved rollers, patented in 1827, consisted in the application, for the first time, of the engraved rollers; for this purpose the yarns were afterwards separated into hanks, for the purpose of "ageing" the mordant and for the convenience of dyeing with madder. These hanks were afterwards woven into cloth, exhibiting the pattern between alternate stripes of plain coloured yarns. The process was stopped for some months by the Excise officers, who thought these after products ought to pay the same duty as calico prints, but the law officers of the Crown, finding it was not within the terms of the Act of Parliament, but the process was ultimately allowed to proceed. Eventually, this and other circumstances led to the entire removal of the Excise duties on prints.

Shading in stripes has been very successfully performed by the cylinder machine from engraved rollers. This is done by mixing the different tones of colour upon endless sieves, before the colour is applied by them to the roller, which afterwards, by the assistance of the "doctor" on its surface, completes the more perfect gradation and mixture of the tints.

A mode of producing all the pale shades of a design, by the application of one block or roller, was patented by me in the year 1850. It is applicable to either hand or machine printing. The preparation for printing the design is made in the usual way, a roller or block being appropriated to each separate colour, excepting all the pale shades in every part of the design, which are omitted in the "preparation" coloured sketch, as if they were not intended to be there. In this state the design is transferred to the rollers or blocks. The pale shades, which constitute the high lights in every portion of the design, are then added to the "preparation" sketch, and all these high lights or shapes, representing the palest shade of every colour in the design, are then transferred to one roller or block, which is called the "reducer." To produce pale shades and tints of colour, the tones may be reduced by the action of antagonistic chemicals, or by the admixture of solutions of gum, and other similar thickeners, slightly charged with mordants. Thus, the "standard" of any colour is its full strength, and generally produces the darkest shades. By diluting these standards in certain proportions with reducing liquids, almost all the lighter shades are obtained. For example, one part of the standard to 25 or 30 parts of reducing liquid is about the proportionate reduction for the palest shades, which we will call the No. 5 shade of a colour. These No. 5 shades have, in measured quantity, about one-half less of the colouring matter than the No. 4 shades contain; and therefore if the proper quantity of reducing liquid is put upon the cloth, and the No. 4 shade printed upon it, the No. 5 shade is produced; the cloth, being saturated with the reducing liquid, rejects a portion of the colour from the engraving, and an admixture of the two is the result; a due proportion of the fourth shade being retained by the block or roller, and a corresponding proportion of the reducing liquid being retained by the cloth. The reducing of the shades may be effected by the partial destruction of the fourth shade of colour, or by such chemical agents in the reducing liquid as will insure the desired change.

We have now approached the period when the old method of engraving rollers (thought to be so perfect) is about to be superseded by the use of "the pentagraph," by means of which the design, enlarged to five times its intended size, is, by a series of obedient diamonds, etched upon the roller, of the required scale. This new method, the invention of Mr. Cripps, of Manchester, promises to become of general application, and will probably create a revolution in that branch of the trade. I have seen some very beautiful specimens of printing on muslin from rollers engraved by this process, the production of Messrs. James Black and Co., of Glasgow. The outlines were extremely well defined, and the register of the colours and general effect such as to leave but very little margin for further improvement.

The printing of woven carpets is a recent and novel application of the art. In operating on plain velvet pile and terry goods, it is necessary not only to print the surface or end of the pile, but to cover the whole depth of it with colour. The dimensions of the design are generally far beyond the ordinary size of common printing blocks, and the variety of shades of colour required to work them out renders the employment of powerful and accurate machinery a matter of absolute necessity.

The apparatus by which I have succeeded in printing carpets is composed of a series of block-printing machines, firmly joined together at equal distances, by means of connecting shafts and gearing; the whole are actuated in one simultaneous movement, so that the combined efforts of all the machines in the series are employed at the same time upon one piece of carpet and the same design, each printing in different colours. By this arrangement I am enabled to print patterns of large dimensions on pile fabrics, where a too frequent repetition of the design is generally considered detrimental to the effect required. By increasing the number of machines in the series, I can work out large designs in any number of colours, or shades of colour, and produce at a single operation a richness and variety of effect never before accomplished by mechanical contrivances, and with a rapidity and precision not to be equalled by the slow process of block-printing by hand. The carpet is made to enter at one end of the apparatus, and is carried at intervals, by the action of the machine, the exact length of the design. The carpet is carried through the machine by an endless carrying cloth, which is a very important part of the operation, as upon the accurate movement of this cloth the lengthways register of the design entirely depends. It is, therefore, necessary that the carpet, when laid thereon, should be immovable. This is effected by the use of small pin points, which project from the outer surface of the carrying cloth, in which they are fixed. They must be left of a sufficient length to enter the foundation of the carpet, but not to pass through into the pile. It is also necessary that the carrying cloth should move through the machines in a straight, undeviating line, and also that it should stop while the blocks deliver their impressions. This is effected by the use of endless flexible steel bands, attached to the sides of the carrying cloth; and to these bands small studs and rollers are fixed, at suitable distances, which are made to traverse in longitudinal grooves the whole length of the series of machines. At exact distances in the steel bands, there are small holes, which work upon studs placed in the periphery of the entering and delivering drums, placed at each end of the apparatus, and round which the endless carrying-cloth is tightly drawn. By this means a correct advancing movement of the carpet is insured. In printing carpets, two, three, or four repeated impressions of the blocks are sometimes necessary, in order to deposit a sufficient amount of colour to stain the pile to its foundation. By the mechanical action of the machine, the pressure of each succeeding impression can be varied, the first being well forced into the cloth, whilst the last application is placed lightly on the surface, ensuring a more brilliant effect in the finish. Besides the pressure which the machine exerts in depositing the colours on the carpet, other means are adopted for ensuring their sinking to the bottom of the pile. Before the colours are applied to the carpet in the printing machine, it is subjected to the usual process of preparation or mordanting, by passing it through a weak solution of sulpho-muriate of tin, and afterwards through chlorine and sulphuric acid, also diluted to about half a degree above the water float of the hydrometer. This preparing process for topical colours is required in order to fix the colour upon the fibre, which, being well saturated with the mordant, becomes the medium for their chemical combination. After the cloth has been well washed by machinery (a process which does not remove the mordant) it is then wound smoothly round a circular cradle or hydro-extractor, which, by revolving on its axis at a high speed, discharges, by centrifugal action, every loose particle of water from the carpet. It is then in a fit state to be printed. The colour being applied to it in this moistened state (without the excessive pressure which would otherwise be required) sinks evenly to the foundation of the pile; the damp woollen fabric being an excellent conductor for the colour, and being softened by the mordant, absorbs the dye much easier, and with more certainty, than would be the case if the colour was applied in the ordinary manner, after the fabrics are dried.

The enormous pressure upon large flat surfaces, which would otherwise be required to force the colour into the pile, would completely destroy the outline, and create confusion and a general mixture of the tints. The colours are found to be more permanent by adopting this method, and the general effect is softened and improved. The blocks employed for the printing of carpets are of greater dimensions than ordinary blocks. The largest used at present are 56 inches long by 27 inches wide. With eighteen blocks I can, by working two or three colours upon some of them, produce very rich and elaborate styles. These blocks are prepared in the following manner:—The design is transferred to checked or point paper, as designs for weaving are prepared. In like manner the surfaces of the printing-blocks are prepared, by cutting them in lines each way, so as to form checks of a corresponding number of squares all over the surface, each block being made a fac-simile of the others. This is done without any reference to the design. It is then only necessary to mark those squares on each block which represent on the point paper the particular colour in which that block is to work. These squares are afterwards left in relief by removing the intermediate parts. Each block thus carries on its surface certain portions of the design, every coloured square on the point paper being represented by the corresponding square on one or other of the blocks. The colour is not furnished from flat sieves, but from rollers. Each section of the apparatus works with two blocks, which deliver their impressions on one table, taking up their colour in passing to and fro over the colour rollers, as they are moved laterally by the traversing frames, where they are placed on springs, which raise them after they have been forced down upon the carpet by the action of the machine. In the construction of the machinery very great accuracy is necessary to insure correct work. The blocks being distributed in their proper places in couples through the whole series of machines, they deposit their colours upon the carpet with varying pressure, as the carpet is carried through upon the endless cloth, stopping at each length of the design, and receiving the impressions from the different blocks, until it leaves the apparatus with the perfect design upon it, exhibiting each square fitted to the other in precisely the same order and regularity as they are seen represented upon the original transfer. The machine, with the drying apparatus attached, weighs 72 tons, and will print 1,500 yards of carpet in twelve hours. After the carpet is dried it is taken to the steam box, in which it is hung for two hours, and subjected to the action of steam at considerable pressure. This softens the colours and fixes them to the fabric, and is analogous to the boiling operation in the process of dyeing. The carpets are afterwards washed by machinery for two hours, to remove the superfluous parts and the thickening of the colours. They are then dried, dressed, sheared, and finished for the market.

The carpets printed by the apparatus above described, are known in the market as Bright and Co.'s carpets. They are woven by the power loom, Mr. Sievier's invention, which raises the pile without the use of a wire. Carpets thus manufactured, though inferior in some respects to the superior qualities of woven carpets, have the recommendation of cheapness, and, inasmuch as they will wash and clean, without injury to the colours or derangement of the pile, have a decided advantage.

The printing of woollen yarns for carpets, on Mr. Whytock's principle, has grown to an enormous trade; but this portion of the subject has been so recently before the Society, and the process so well explained in Mr. A. Whytock's paper, that I will pass it by.

Printed druggets have been an article of commerce for some years; large quantities have been exported to the United States, and the home consumption is very considerable. They are printed generally with medium size patterns by hand blocks, in from two to six colours, which are fixed by the steaming process. The patterns employed do not generally cover the ground of the drugget, which is mostly left white. Felted cloths have also been printed and used for the same purpose, and to some extent have superseded the druggets, on account of their lower price. Many of them have been printed in the Borough-road, London, by the Felt Company; the remaining portion in Yorkshire. The low qualities of printed Brussels carpets have lately interfered very much with the sale of these goods, and the manufacture in consequence has considerably diminished.

Nothing will tend more to encourage the art of design, as applied to calico printing, than the improvements which have lately taken place in the rapid execution of the blocks and rollers. Formerly it was necessary to commence preparations for a spring trade at the end of the previous summer. The decision then made, as regarded the selection of designs for the ensuing season, was stereotyped, and no chance afterwards would exist for any change or renewal, however unfortunate and unsaleable the patterns might prove. Thus the trade was very speculative, depending on the accident of a style or the caprice of fashion. This early commencement was necessary, not only on account of the time required for the preparation of the blocks, but also in consequence of the old method of bleaching the madder stain from the cloth, which was done by exposure to the atmosphere and to the rays of the sun. Chemistry has now supplied the means of accomplishing the removal of the stains, and has effected changes in those other processes which formerly required weeks to complete. The printer of the present day can change his stock of patterns in a few days. His rollers may be turned off and re-engraved with other patterns by the pentagraph; and the metal blocks melted up, and re-cast into more acceptable designs while the "season is on."

Too much cannot be said in favour of schools of design, or too much done to support and encourage them. Although of comparatively recent origin, their usefulness is already felt in many districts, and their influence will increase. In my opinion, the art of drawing should become a more general branch of education, and should take precedence of many studies which have hitherto, and, I am afraid, are still, too much considered indispensable, and for the attainment of which too much valuable time is thrown away.

The length to which this paper has already run warns me that I must not dwell upon this point, though its importance, both commercially and otherwise, cannot be too much pressed upon our consideration.

The limits of this paper will not permit me to touch upon the chemistry of printing; that is a section of the art I will leave to abler hands. While treating on the subject of shawl and carpet printing, to which this paper has special reference, I have been compelled to speak of some of my own inventions, which are intimately connected with the improvements in both those manufactures.

In the following remarks, I wish to be understood as addressing myself, not to individuals, but to the Manchester and Glasgow printers generally, between whom the race for precedence mainly lies. In my opinion, the Glasgow printers are distancing their competitors. Many circumstances have conspired to convince me of this. If there be any new process or machine, inquire for it at Glasgow; you will not find it in Manchester. Manchester desires no improvements, and is content to jog on in the old track. Glasgow seeks and encourages every novelty. If quantity is wanted, it is to be obtained in Manchester; but if quality and quantity are required, it is becoming necessary to go further north. The de laine trade, the handkerchief trade, the shawl trade, and the muslin trade, are now principally in Glasgow hands, and they do them well. Manchester is dropping behind, and although some talented spirits are still urging on the race, such as the Hoyles, the Hargreaves, the Dugdales, and the Margeresons, Glasgow's energies increase.

Specimens were exhibited of white cloth dried up at its different stages, supplied by Mr. Hall, the manager at the Busby Print Works (Messrs. Inglis and Wakefield); also specimens showing the various stages of the process of printing by the cylinder machine with mordants, and raising with madder dye. Specimens of mousselines-de-laine printed in topical colours, showing the different stages of the process. Specimens of machine printing from engraved rollers in fast colours, raised from cochineal upon acetate of iron and aluminous mordants; of machine printing in topical colours; and of machine printing in madder dyes, by Messrs. James Black and Co., Glasgow. The rollers for the madder dyes were engraved by means of the pentagraph, by Messrs. Stephen and Fulton, Glasgow. Four specimens of fancy summer barèges, muslins in topical colours, printed by hand, by Messrs. Inglis and Wakefield. Specimens of furniture printing by the cylinder, with twelve engraved rollers. Specimens of shawls printed by the magnum drum machine from surface rollers. Specimens of Bright and Co.'s carpets:—1. The white cloth velvet pile and terry; 2. Sample printed, but not steamed; 3. Sample steamed, but not washed; 4. Sample washed and finished. Sample of an old London print, produced in London upwards of one hundred years ago, from wood-engraved blocks. An engraved roller for cylinder printing. A bordering machine, by Mr. Applegath. An old wood-engraved block. A coppered block. A cast type metal block. A mould. A casting bent, as applied to surface rollers. A casting as taken from the mould, with runners attached. A mould with casting, and casting boards before separation. A box of steel punches. A set of carpet-printing blocks.

DISCUSSION.

Mr. P. Graham said, with regard to the machine for printing carpets, invented by Mr. Burch, he would say, having witnessed it in operation, that it was an invention of the greatest talent and ingenuity, and he believed Mr. Burch had the credit of having turned out the first marketable piece of printed carpet. But for that machine, the patent of Sievier, for weaving a pile carpet without the wire, would have been almost valueless. Other inventions for printing carpets had certainly been patented, but he was not aware that any had yet been brought into operation.

The Chairman having expressed his willingness to give the meeting some information upon the process of shawl printing, &c., called attention to a specimen he exhibited, showing the various stages of printing a pattern of an elaborate character from twelve blocks, progressing from very faint and indistinct colourings, up to the perfected pattern. [These blocks were exhibited.] For filling in the dark ground of the pattern, a thirteenth block was applied. He explained that the number of times the blocks were laid upon a shawl of the pattern exhibited was 820 without the ground-work, and with the coloured ground 1,080 times. When a small filling in the centre was added to the shawl, the blocks were applied no fewer than 1,272 times, including the border and the centre. Two of the shawls exhibited by him, he stated, had 1,600 layings of the blocks to complete the printing of the patterns. This, he said, afforded as familiar an explanation as could be given of the process of printing fabrics, where blocks were employed. With regard to the opinion that block-printing would be superseded, he thought that was quite out of the question; where fine productions were required, the blocks could not be superseded. They had, however, at the present day, managed to unite block and roller printing together, by which means they had got over the difficulty mentioned in the paper, of the first and early colours becoming impoverished through the repeated application of the subsequent rollers. He held in his hand a specimen of barège printed by four rollers and four blocks, by which means the finer colours were not destroyed by the repeated passages over the rollers. That was a specimen of foreign manufacture. He had mentioned that one of the shawls exhibited had received no fewer than 1,600 impressions from the various blocks, and yet the market price of that article was only 21s. 9d. wholesale. Out of that sum there was 9s. for the cloth alone, leaving only 12s. 9d. for the workman's time, the colour, and two profits, those of the manufacturer and the printer. The meeting might therefore judge how quickly the shawls must be printed to enable them to be sold at such a price. He then exhibited other specimens, in which variety was produced by changing the colours employed, the blocks remaining the same. In some cases, there were twelve different arrangements of the same pattern. He also exhibited specimens of type patterns, which were cast from a mould in wood, and were afterwards placed upon blocks of wood of the required height, in the same manner as stereotyped plates were used for letter-press printing. These had been found to be a great improvement upon the wood blocks for the finer descriptions of patterns. He also exhibited some wood blocks engraved a hundred years ago, which, although very fine and intricate in the engraving, were not, he said, to be compared with the productions of the present day. Eighty, or a hundred years ago, a printed fabric was sold as high as 8s. or 10s. per yard, which could be had at the present day for 2s. a yard; therefore, the printers of that period could afford to bestow more time upon the engraving of the blocks than the prices of the present day would admit. The author of the paper, he thought, had said too little about the printing that was carried on in the environs of London. Some of the shawls exhibited were what was called town printed, that is, printed in the suburbs of London, whilst others were printed in Scotland. An inspection would show the fineness of the printing of the former as compared with the others. Possibly, the articles of Glasgow manufacture were of a cheaper description, labour being cheaper in Scotland than in London, added to which it was probable, that more time was devoted to the production of the finer description of goods in London. He would mention another description of goods, to which only a slight allusion was made in the paper, viz., mousselines-de-laine. The patterns on this fabric were formed by what was called compartment printing, by which three are four colours were printed together. The colour sieves were divided into compartments: three or four different colours were put into the sieve at a sufficient distance from each other, and two, three, or four colours were impressed upon the fabric at the same time, at such distances apart as to prevent mingling. The same process had been applied to other printing as well as to woollen with success. (Some beautiful specimens of printed flannel were here exhibited.) The Chairman went on to remark that, compared with the blocks used by Mr. Burch for carpet printing, those used for the finer fabrics would appear extremely small, but in the smallness of the blocks the facility of working consisted, and taking the number of times that the blocks were applied, it was necessary to have them of a convenient size for handling and lifting by the workman. The carpet blocks, however, were only multiplied sizes of those exhibited on the table. (There were also exhibited very beautiful specimens of barège and muslins, richly printed, also specimens of muslin roller printing, in which two and three rollers had been employed, also block printed muslin.) The Chairman remarked that it was impossible to say to what perfection roller printing might be brought, but he considered it doubtful whether it would ever supersede the use of blocks in the printing of the finer fabrics, where richness of colouring was required.

A Gentleman inquired whether roller printing was the cheapest.

The Chairman replied, that it was cheaper by far. The length of time that a piece of block-printed muslin was in hand varied from one to three months, whereas roller work was generally passed out within a week. The essential of roller work was, that the adjustment should be quite perfect. The roller took up the colours, and the cloth was made to pass under it as quickly as possible. A great many of the finer fabrics exhibited were of foreign manufacture, that of Messrs. Gros, Odier, Roman, and Co., of Wesserling (Haut Rhin), and more time was bestowed upon them than could be afforded in England, on account of labour being so much cheaper in France and Switzerland. The best workman in those countries would not, probably, be paid more than 2s. 6d. per day, whereas a man doing similar work in London would earn 7s. or 8s. There were whole villages in France and Switzerland where nothing else but printing fabrics was done, and one establishment, where the specimens exhibited were printed, employed as many as 5,800 people. In the foreign manufacture quality was regarded rather than quantity, whereas in England, owing to the great demand which existed, the reverse was generally the rule.

Mr. Winkworth asked the chairman whether he endorsed the opinion expressed by Mr. Burch, that the manufacturers of Glasgow were outstripping those of Manchester.

The Chairman.—Most decidedly. He hoped, however, that the Manchester printers would see their error in time to prevent loss of trade.

Mr. Winkworth would ask another question, arising out of the chairman's observations. He had spoken of a certain class of shawls and mousselines-de laine as being cheap compared with others; for instance, that the Glasgow printed shawls, &c., were cheaper than those printed in the neighbourhood of London. He wished to ask whether the chairman meant by that to convey that they were precisely the same kind of goods, but because the expenses of production in the neighbourhood of London were higher, they could not be sold at the same price as they could at Glasgow, the expenses being so much less.

The Chairman said, that was not exactly his meaning, longer time being given to the town printing and more skilful hands employed.

Mr. Winkworth.—Then if there was no superiority of workmanship in the neighbourhood of London, they could not carry on any business? Because he should suppose that there must be some characteristic attaching itself to the printing in and about London which made the goods acceptable to the purchaser over and above that which was done at Glasgow.

The Chairman.—What I meant was—if you removed one of the London manufactories to Glasgow, you could produce the same work there. There would be no difficulty whatever in doing so. Supposing, for instance, Mr. Swaisland, having a manufactory in the neighbourhood of London, removed to Glasgow, he would have no more difficulty in producing his work there than in London.

Mr. Winkworth.—How does he sell his goods?

The Chairman.—There is more time given here, and there is not the same necessity for establishments of that description in Glasgow as in London. It is necessary to have your establishment near to where the goods are required; and the daily communication which must be had with the persons who produce these shawls require it, as a matter of necessity, that he should be upon the spot.

Mr. Winkworth thought the Chairman had not made adequate allowance for the means of transit between Glasgow and London which now exist.

The Chairman was quite aware of the facilities of transit which exist at the present day; but, at the same time, it was necessary that the printer and the seller should be in immediate personal intercourse, and no facilities of transit would enable that to be done, because there might be twenty or thirty trials before the shawl was produced in saleable colours; and, if they had to send to Glasgow, a season might expire before the arrangements were completed.

Mr. Winkworth.—Then, the result of the whole matter is—that Mr. Swaisland, and other town printers, having all the advantages of immediate intercourse with the designer and the buyer, do, after all, produce the best articles?

The Chairman.—Articles similar to these.

Mr. Winkworth.—I want to arrive at this—that, after all, the work produced in and about London is a more finished article than that produced at Glasgow.

The Chairman.—Decidedly.

Mr. Winkworth.—Then, although it is produced at Glasgow at a lower figure, it does not follow that it is a cheap article, because it is at a lower price?

The Chairman.—Certainly not.

Mr. Winkworth.—Because you made use of the word "cheap;" but I thought you meant a lower price article, because it was inferior in design.

The Chairman.—It is produced more quickly, and consequently not so carefully finished.

Mr. Hanhart had heard with pleasure the compliment which had been paid in the paper to his native place. He attributed a great deal of the excellence that had been attained there in this description of manufactures, to the practical education that was imparted to those who were engaged in this particular trade. The greatest facilities were given for evening instruction in drawing, and also in the science of chemistry, which was so intimately connected with this branch of manufactures. He was happy to number amongst his personal friends several of the first designers of the present day. He attributed the excellence which had been attained to the facilities for acquiring, and the encouragement given, to those who obtained the practical education spoken of.

Mr. Lavanchy had hoped that some one connected with the printing department of Mr. Swaisland's establishment would have been present to afford some information on this subject. It was true that Glasgow had turned out some very beautiful patterns of printing, but he believed the great superiority of Mr. Swaisland's goods consisted in the fact, that a clear outline was given to almost every colour. To accomplish this double blocks were required. The fabrics of Mr. Swaisland were, by these means, made to approach more nearly than any others to the woollen fabrics, from the fact that each colour possessed a clear outline.

A vote of thanks having been passed to Mr. Burch for his interesting paper,

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 7th instant, was "Fires: the Best Means of Preventing and Arresting them, with a Few Words on Fire-proof Structures," by Mr. Jas. Braidwood, Superintendent of the London Fire Brigade. On this evening John Thwaites, Esq., Chairman of the Metropolitan Board of Works, will preside.

EXAMINATION OF CLASSES IN INSTITUTES.

Sir John William Ramsden, Bart., M.P., gives a Prize of Ten Guineas to be awarded to the candidate who shall pass the best examination in English Literature, English Composition, and Writing from Dictation, and obtain a first-class certificate therein.

The Society's Examiners for "Free-hand Drawing in Outline from Objects," name, as a Text-book on this subject, Rudimentary Art Instruction for Artizans and others, and for Schools, prepared at the request of the Society of Arts, Manufactures, and Commerce—Free-hand Outline, Part I.; Free-hand Outline, Part II. Bell and Daldy.

The following letter, enclosing five pounds, has been received by the Council, for which they beg to offer their best thanks:—

April 24, 1856.

Sir,—I beg to offer, subject to the approval of the Council, five pounds towards defraying one day's expenses in London for ten young men from the country, should there be any candidates at the coming examinations disposed to accept a trifle from

A FRIEND.

To the Secretary of the Society of Arts.

The Council have directed inquiries to be made for the purpose of enabling them to furnish information to candidates in reference to suitable board and lodging during their stay in London.

RATING OF INSTITUTES.

In compliance with the desire expressed at the Conference of Representatives from Institutions in Union held last July, the Council have had prepared with the advice of the Committee to whom the subject has been referred, the subjoined Bill, which is about to be introduced into *the House* of Commons. Any suggestion for its improvement may be sent to the Secretary to the Society of Arts.

AN ACT TO AMEND AN ACT TO EXEMPT FROM COUNTY, BOROUGHS, PAROCHIAL, AND OTHER LOCAL RATES, LAND AND BUILDINGS OCCUPIED BY SCIENTIFIC OR LITERARY INSTITUTIONS.

Whereas, by an Act passed in the sixth and seventh years of the reign of her present Majesty, it was enacted that, "from and after the 1st day of October, 1843, no person or persons shall be assessed, or rated, or liable to be assessed or rated, or liable to pay to any county, borough, parochial, or other local rates or cesses, in respect of any lands, houses, or buildings, belonging to any Society instituted for purposes of science, literature, or fine arts exclusively, either as tenant or owner, and occupied by it for the transaction of its business, and for carrying into effect its purposes; provided that such Society should be supported, wholly, or in part, by annual voluntary contributions, and should not, and by its laws might not, make any dividend, gift, division, or bonus in money, unto or between any of its members; and provided also that such Society should obtain the certificate of the barrister-at-law, or lord advocate, as thereinafter mentioned."

And, whereas it is expedient to amend the said statute, be it therefore enacted as follows:—

From and after the 1st day of January, 1857, the aforesaid provision, as also the whole of Section 6 of the said statute, shall be repealed.

On and after the 1st day of January, 1857, no person or persons shall be assessed or rated, or liable to pay to any county, borough, parochial, or other local rates or cesses, in respect of any lands, houses, or buildings, or parts of houses or buildings, belonging to any Society instituted for purposes of science, literature, or the fine arts, either as tenant or as owner, and occupied by it for the transaction of its business, and for carrying into effect its purposes; provided that such Society shall be supported, wholly or in part, by annual voluntary contributions, and shall not, and by its laws may not, make any dividend, gift, division, or bonus in money, unto or between any of its members; and provided also that such Society shall obtain the certificate of the barrister-at-law or lord advocate, as mentioned in the said statute.

Whenever any such Society shall have obtained the certificate of the barrister-at-law or lord advocate, and the laws, rules, and regulations of the Society shall have been allowed and confirmed by the recorder of any borough sessions, or the justices at any general quarter sessions, or if such certificate of the barrister-at-law or lord advocate shall be refused; but such recorder or justices, on such laws, rules, and regulations being submitted to them respectively, shall order the same to be filed, notwithstanding such refusal, then it shall not be lawful thereafter to assess or rate any person or persons, nor shall any person or persons be liable to be assessed or rated, or liable to pay to any county, borough, parochial, or other local rates or cesses, in respect of any land, houses, or buildings, or parts of houses or buildings, belonging to any such Society as aforesaid; and any such assessment or rate, if made, shall be wholly void, and no person or persons assessed to any rate from which any Society shall be exempted by this Act shall have any appeal, or right to appeal, against such certificate, or against such allowance, or confirmation, or filing of the laws, rules, and regulations, as aforesaid. Provided, nevertheless, that if at any time the laws, rules, and regulations of any such Society shall be altered or varied, or if any such Society shall be conducted for purposes different from those set forth in the laws, rules, and regulations, after the same shall have been allowed and confirmed, or filed, the exemption from rates and cesses herein contained shall cease. But nothing herein contained shall prevent any such Society from applying for a *fresh certificate*, or from applying to have its laws, rules, and regulations again allowed and confirmed, or filed, as often as need be.

COMMERCIAL MUSEUM IN LIVERPOOL.

When the Liverpool Collection of Imports was returned after the Great Exhibition of 1851, it was presented to the Town (or Derby) Museum, then forming in connection with the Free Public Library. It was conceived that it might be made the nucleus of a local Trade Museum, and that, by an expenditure of under £200 per annum, it might be arranged and extended. The Committee, however, opposed the outlay, as useless. But the Directors of the Royal Institution, seeing the great want of a Commercial Museum in so important a port as Liverpool, have determined to endeavour to supply it. They have converted the spacious Gymnasium into a Museum, capable of receiving a large collection, which it is intended to arrange after the plans adopted at Kew, at the Museum of Practical Geology in London, and the Trade Museum of Animal Products founded by the Society of Arts. Mural and table cases, of upwards of one thousand superficial feet in extent, have been provided for the reception of botanical specimens and vegetable products alone. The animal and mineral departments are not yet commenced. There is also a large open space down the centre, in which it is hoped that spirited firms and individuals will find it to their interest to place groups or trophies of their manufactures. A large wall space is provided for contributions of botanical plates and drawings. A dwelling has been erected for a Curator.

It is intended that the collection, when formed, shall be made available, as far as possible, to the public.

As its success will, in a great measure depend upon contributions of specimens from private individuals, active steps are being taken to secure the necessary co-operation. In the meantime, it may be useful to point out that specimens of manufactures from vegetable substances, and vegetable products used in manufactures, are particularly desired. They should be forwarded, addressed to Mr. T. C. Archer, the Honorary Director of the Museum.

Home Correspondence.

REMARKS ON MR. BENNOCH'S PAPER ON FIBRE GILDING.

SIR,—In the able paper read by Mr. Bennoch, at the Society of Arts, on the 16th inst., on "Thread and Fibre Gilding," I cannot but regret that that gentleman should have passed so summarily over the origin of fibre gilding in this country. In the prefatory remarks to that portion of the paper relating to fibre gilding, Mr. Bennoch observes—"For many years chemists have attempted every known method of gilding, in the hope of discovering some process by which silk, or other fibre, could be gilded without applying the immense labour seen to be necessary before a thread with a covering of gold can be used with facility in the loom, and woven into cloth—*but they always failed*. In France, where scientific research is liberally promoted by the Government, a large reward was offered for a successful plan, but no man ever had the opportunity or satisfaction of claiming it." In the next paragraph, Mr. Bennoch states that, "among the several investigators was Mr. Albert Hock, who, failing to find in chemistry the principle by which fibres could be gilded, succeeded by means of a simple mechanical contrivance."

Now, although unacquainted with the fact that the French Government had offered a reward for a successful plan to gild fibres, I would beg to state that for the past five years my attention has been devoted to this important subject; and in May, 1853, a patent was granted to me for the invention of fibre gilding, as also for covering threads with ultramarine, emerald green, and other colours in a state of powder. As Mr. Bennoch has not stated when Mr. Hock commenced his investigations in the matter of fibre gilding, or when he obtained the results upon which was based the patent afterwards granted to Mr. Bennoch in this country, it would perhaps be premature for me to say to whom the credit of the invention of fibre gilding belongs—to Mr. Hock or myself. As, however, my patent is dated seven months prior to that of Mr. Bennoch, I may assume—in the absence of proof to the contrary—that the invention, as well as the *right to practice* the same, belongs to me.

As economy in the cost of production is an important feature in any invention intended to meet the wants of 150 millions of people, I, in the first place, devoted my attention chiefly to the employment of metallic powder for the accomplishment of the desired object, by means of which I had the satisfaction of producing, not only a bright metallic, or partially metallic, thread, but also a very near imitation of silk. In the course of my investigations, however, I employed metal leaf, gold leaf, brocade or fragments of leaf, metallic solutions or compositions, and the electro-plating process; and in my patent I specified and claimed these several methods of fibre gilding.

When metallic powder is employed, the mode of operation is as follows:—The thread or fibre to be prepared is first dyed in the usual way, and is then placed upon a swift or reel, from which it may be made to pass through the flame of a gas-burner, if so desired, in order to remove all the loose filaments projecting from its surface. It is then passed under a roller, or rollers, working in a trough containing a flexible, transparent, and adhesive composition. It then passes between pads of leather or india-rubber, where it is pressed lightly, so as to remove any superfluous size or gum, and to equalise the same. It then passes over or between rollers covered with fustian or other soft material, and revolving in a trough containing the powder, by which means the fibres are perfectly coated with a very thin layer of metal. It then passes on to spools or reels, to which a slow horizontal motion is communicated by means of a screw or threaded spindle, for the purpose of causing the threads to lay evenly side by side. A tremulous motion may be communicated to the reels on to which the fibres are thus wound, or they may be brought into contact with a brush, for the purpose of removing any superfluous powder; and, when so desired, a current of hot air is forced thereon, for the purpose of drying it. In some cases, the metallic powder is mixed with a glutinous matter, and applied as before described. Also, in some cases, the fibres may be only partially covered. When metallic solutions or compositions are employed, black lead, or other cheap metallic powder may be used in lieu of bronze, and a gilt or silvered surface then produced by the electro-plating process. Whichever mode of gilding the fibres may be employed, a bright metallic lustre is afterwards imparted to the metal by passing the fibres over or between highly-polished steel or other surfaces, or rollers, either cold or heated.

When greater brilliancy is required than can be obtained by the use of metallic powders or solutions, I use, in lieu thereof, gold leaf, metal leaf, or fragments of leaf; the leaf being applied to the fibre by hand, after the glutinous matter, in any convenient manner.

The immense importance of a cheap and efficient method of fibre gilding, both in a commercial and national point of view, must be my apology for troubling you with these further particulars on the subject.

I have, &c.,

WILLIAM GREEN.

57, York-street, City-road, London, April 19, 1856.

MATERIALS FOR KNIFE-HANDLES.

Sir,—It appears that the want of materials for knife-handles is a frequent drawback, I therefore beg to suggest the use of Reaumur's porcelain for this purpose. It appears from the memoir of the late General Bentham, that he had made crucibles of this material, so insensible to heat, as to bear, when red hot, to be plunged into cold water without breaking; and in his letters he indicates this composition as suitable for knife-handles. Its cheapness would, moreover, be a recommendation.

Yours truly,

M. S. BENTHAM.

Proceedings of Institutions.

Bedford.—On the evenings of the 14th and 15th April, Mr. George Dawson, A.M., of Birmingham, gave two lectures in the Assembly Room; the first on "John Bunyan," the second on "Beau Brummell." The character of the "glorious dreamer" was admirably drawn, and not less cleverly that of the renowned "king of fashion." Placed in contrast, their lives were deeply interesting, and excellent lessons were educed. The audiences were numerous, and cordial thanks were voted to Mr. Dawson for his lectures. The chair was occupied on the first evening by Mr. Wm. Blower, and on the second by Dr. T. H. Barker, Vice-Presidents of the Institution.

Brighton.—The half-yearly report of the London, Brighton, and South-Coast Railway Literary and Scientific Institution states that, since the last report, the number of members had increased from 261 to 563 at the expiration of the first quarter, and at the close of the half-year to 449, out of which number 38 became yearly members. The committee recommend that the Saturday evening concerts, which have been most attractive during the winter, should be continued throughout the summer season. During the half-year considerable additions were made to the library; and the several classes in connexion with the Institution have been creditably attended. The balance-sheet shows that the receipts proper to the half-year were £148 8s. 10¾d., the expenditure £145 8s. 1d., leaving a balance in favour of the Institution of £2 15s. 9¾d., in addition to a balance of £11 8s. 10½d. brought forward from the last report.

Poole.—The conversazione of the Literary and Scientific Institution was held on Monday evening, the 21st of April. The chair was taken by Admiral Browne, of Parkstone. Letters of apology were read from Colonel Waugh, who was to have presided, and from the Hon. and Rev. S. G. Osborne, who said that he regarded these institutions at the present moment as of the greatest national value. Brief addresses having been made by the Chairman, the Rev. E. R. Conder, and Mr. Penney (the honorary secretary), the Chairman called upon Mr. Budden to read the first paper "On Clay and its Products." After speaking of the composition of clay, and of the metal aluminium, Mr. Budden went on to describe particularly the Poole clay. He stated that "large quantities of this clay are sent by sea and rail to the Staffordshire and Vauxhall potteries to be made into articles of domestic and other uses, and to form the finest porcelain, while a considerable quantity is expended in the manufacture of alum. It has long been a subject of regret that Poole, while possessing in such an eminent degree the elements of great manufacturing and commercial prosperity, should have been wanting in men capable of developing her resources; but the many beautiful specimens now contributed of the manufactures of Poole and its neighbourhood sufficiently indicate the advent of a new era in the commercial history of the town." Mr. Budden's remarks were illustrated by specimens of the new metal aluminium, lent by Professor T. Redwood, of the Pharmaceutical Society; also numerous articles from the Branksea Pottery, including some beautiful terra cotta figures; and statuettes from the Bruce Pottery. There were likewise two cases from the Architectural Pottery, at Hamworthy, containing a large assortment of their newly patented glazed and coloured bricks, with several cases of richly designed paving tiles. The object of this company, Mr. Budden observed, was not only to produce a brick of superior quality, but by the employment of various glazes and veneers to form a building material equal in smoothness and beauty to tinted glass or the finest porcelain, to enable us to construct a palace that would bid defiance to the influence of our humid and smoke-corrupted atmosphere, to keep the purest white for ever white, to preserve unsullied the most refined gold, and to banish red brick from the face of our architecture.—Mr. E. Kemp Welch then read an interesting paper on "Steam and its History," which concluded with the words, "that the first modern engine was Watt's, a Scotsman; the first modern locomotive was Trevethick's, an Englishman; and the first modern steam boat was that of Symington, a Scotsman. The American, Fulton, constructed the first regular river steamer, and the first ocean steam voyage was made by Bell, a Scottish engineer."—The third paper was entitled "The History and Chemistry of Photography," by Mr. W. Penney, in which he gave a brief account of the early experimenters in this art, and described the daguerreotype, calotype, and collodion processes. The paper was illustrated by numerous specimens, and among them a daguerreotype, by Mr. W. Thompson, of the bottom of the sea in Weymouth Bay, at a depth of three fathoms. In it might be recognised the rocks, sea-weeds, and the water-line. In conclusion, he said, this new application of photography might add greatly to our knowledge of the wonders of our sea-covered shores, increase our acquaintance with marine animals and plants, and show the structure of rocks, sands, and alluvial deposits under the sea, as yet unexplored.—The rooms were well filled with various other objects of interest, including Dr. Auzoux's anatomical figures, stereoscopes, stuffed birds, marine shells, &c. Between the reading of Mr. Welch's and Mr. Penney's paper, the company were gratified with a selection of music. The conversazione was well attended, and the discussion which ensued on subjects suggested by articles exhibited in the hall, was highly interesting. The hall was reopened again on Tuesday and Wednesday, and the Exhibition was visited by many persons who were unable to attend on Monday evening.

WIRKSWORTH.—On Thursday, the 3rd ult., an interesting lecture was delivered in the Grammar School, by the Rev. J. Edwards, M.A., Vicar of Barron on Trent, on "Binocular Vision as illustrated by the Stereoscope." As preliminary to the remarks and explanations he wished to give, the lecturer sent round the room a few specimens of beautiful stereoscopic portraits, so as thereby to enlist the sympathy and attention of the audience. He then proceeded, by a series of diagrams and models, to explain the principles of binocular, as distinguished from monocular vision; referring extensively to the valuable papers on the subject by Professor Wheatstone, in the Philosophical Transactions. A model, representing the aspect of a skeleton cube to each eye, very much facilitated the development of the principle, and, starting from this point, the audience appeared with readiness and facility to comprehend the effects resulting from the same principle, in the case not only of more complicated geometrical figures, but of the groupings of portraits and of the varied landscape effects. These principles were developed and explained at some length, and the lecture appropriately closed with a careful and well illustrated description of the Pseudoscope. The correlation of the two instruments was placed in strong contrast; and the attempt was not unsuccessful, by which the lecturer endeavoured to prove how nature may be made, in may instances, to discover her most mysterious agencies. The lecture, which was longer than usual, was listened to by a patient and attentive audience, to many of whom it was well suggested, from the topic of the evening, how, in others of the great operations of nature, they might be successful in discovering her laws and processes by a patient, thoughtful, and untiring investigation of the wonders with which the goodness of God has on every hand surrounded them. The rev. gentleman attended at the Institution to exhibit the beautiful portraits and landscapes on the following evening.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 2, General Monthly Meeting.
Architects, 8, Anniversary.
Chemical, 8.
Entomological, 8.
TUES. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Civil Engineers, 8, Mr. J. Murray, "On the Progressive Construction of Sunderland Dock."
Linnæan, 8.
Pathological, 8.
WED. London Inst., 3, Prof. Rymer Jones, "On Entomology and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. James Braidwood, "Fires; the Best Means of Preventing and Arresting them, with a Few Words on Fire-proof Structures."
Geological, 8, I. Dr. J. G. Croker, "On the Lignites of Bovey Tracey, Devonshire." II. Mr. C. J. F. Bunbury, "On the Appearances observed on Draining a Mere near Wretham Hall, Norfolk." III. Mr. J. C. Moore, "On the Silurian Rocks of Wigtonshire." IV. "Mr. E. W. Binney, "On a Fossil Track in the Millstone Grit of Tintwhistle, Cheshire."
THURS. Royal Inst., 3, Prof. Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.
FRI. Astronomical, 8.
Philological, 8.
Royal Inst., 8½, Mr. Henry Bradbury, "On the Manufacture and Security of Bank Notes," with Photographic and Microscopic Illustrations.
SAT. Royal Inst., 3, "Dr. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on the 22nd and 24th April, 1856.

Par. No.
112. Superannuation (Public Offices)—Account (a corrected sheet).
107. Harbours of Refuge—Detailed Statement.
148. Troops in Turkey—Returns of the Pay and Allowances.
155. Brewers—Return.
105. Bills—National Gallery.
43. Bills—Tenant Right (Ireland).
90. Bills—Factories (amended).
Turnpike Trusts—Third and Fourth Reports by the Secretary of State.

SESSION 1854-55.

449. Scutari, &c., Hospitals—Copy of Official Reports.

Delivered on 25th April, 1856.

156. Hydrographical Survey (Scotland)—Return.
169. National Debt—Account.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette April 25th*, 1856.]

Dated 5th April, 1856.

821. James Jones, Warrington—Improvements in railway chairs, and in the method of securing the rails to the same.
822. James Hogg, South Blacket-place, and John Napier, East Sciennes-street, Edinburgh—Improvements in stereotyping.
823. Obed Blake, Thames Plate Glass Works, Blackwall—Improvements in the manufacture of glass.
824. Benjamin Kisch, Kennington—Apparatus for containing an arrangement of cards or papers for selection. (A communication.)
825. James Webster, Birmingham—Improved elastic metallic tube, and the method of manufacturing the same.
826. Thomas Reeves Whitehead, Manchester—Improvements in garments or apparatus to be used for sustaining the human body in water, or for acquiring the art of swimming.
827. Julian Bernard, Albany, Piccadilly—Improvements in machinery or apparatus employed for manufacturing or making boots and shoes, or other coverings for the feet.
828. Edward Martin, Oxford—Improved leg-guard.
829. Henry Thomas Sturley, Church-street, South Lynn—Improved compound or breakfast mixture.

830. Arnold Morton, Wakefield—Improvements in the manufacture of paints and pigments.
831. William Porter Maddison, Barnsley—Improved telegraph or apparatus for the transmission of signals.
832. William Henry Moore, Wenlock-place, City-road—Improvement in the manufacture of candles.
833. Frederick George Underbay, 13, Well's-street, Gray's-inn-road—Improvements in apparatus for drawing off water.
834. Henry Craigie, Edinburgh—Improvements in heating apartments where gas and water are used.
835. Joseph Betteley, Liverpool—Improvements in the manufacture of iron for knees for ships or other purposes.

Dated 7th April, 1856.

837. Jacob Smith, 9, Union-court, Old Broad-street, John Luntley, 3, New Broad-street court—Treating the sunflower plant to render its fibres applicable to the manufacture of textile fabrics, paper, yarn, cordage, &c.
838. John Leigh, Manchester—The use or application of a certain substance or substances in the sizing, stiffening, or otherwise preparing cotton, linen, or other yarns and woven fabrics.
839. Ephraim Morris, Bergen, U.S.—Improved machinery for raising and lowering weights.
840. William Edward Newton, 66, Chancery-lane—Improved construction of furnace for the manufacture of glass. (A communication.)
841. Charles Durand Gardissal, 10, Bedford-street, Strand—Preparing various resins and combining them with oils and fatty matters for manufacturing candles thereof. (A communication.)
842. Arnold Morton, Wakefield—Improvements in the manufacture of paper hangings for decorative purposes.
843. William Terry, Birmingham—Improvements in breech-loading fire arms.
844. William Coles Fuller, 2, Bucklersbury, Cheapside—Improvements in constructing and adapting india-rubber as tyres for wheels.
845. John Adams, 11, Grosvenor-street, Belgrave-gate, Leicester—Improvements in knitting machinery.
846. William Henry Gauntlett, South Bank Iron Works, Eston Junction, near Middlesbro'-on-Tees—Improvements in thermometric apparatus.
847. John Graves, London, and William Frederick Henson, Hampstead—Improvements in lubricating carriage and other axles.

Dated 8th April, 1856.

848. Stephen Johnson Gold, Newhaven, U.S.—Improvement in apparatus for warming buildings by steam.
849. John Carrick Bowser, Queen's terrace, St. John's-wood—Improvements in glove fastenings.
850. Alexander Charles Louis Devaux, King William-street, City—Improvements in the construction and the fitting up of granaries.
851. William Edward Newton, 66, Chancery-lane—Improvements in the process of manufacturing steel, and carbonizing iron and the ores thereof in the said manufacture. (A communication.)
852. William Joseph Curtis, 1, Sebbon-street, Islington—Improvement in lubricating the axles of locomotive engines and of carriages on railways.
853. James Allen Ransome and George Arthur Biddell, Ipswich—Improvements in the manufacture of railway bars and flanch bearers of railway crossings.
854. John Brooke, 10, Crescent, Jewin-street—Improvements in lift pumps.

Dated 9th April, 1856.

855. John Gedge, 4, Wellington-street South, Strand—Improvements in the treatment or preparation of leather, and in the manufacture of articles composed thereof. (A communication.)
856. Joseph Robert Whitgreave, Rugeley—Improvements in the arrangement and construction of locomotive engines.
857. Henry Laxton, 19, Arundel-street, Strand—Improved apparatus for increasing the buoyancy of ships and other vessels. (A communication.)
859. John Armour, Kirkton Bleach Works, Renfrew—Improvements in bleaching textile fabrics and materials.
860. George Frederick Morrell, Fleet-street—Improvements in the manufacture of railway chairs.

Dated 10th April, 1856.

861. Henry Laxton, 19, Arundel street, Strand—Improved mode of adjusting circular saws. (A communication.)
863. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the means of attaching together or securing sheets and pieces of paper or manuscript documents. (A communication.)
864. Walter Hall, Erith—A method of stopping or retarding the way of ships and vessels, in order to prevent collisions and otherwise.
865. George Homfray, Ruabon—Improvement in furnaces.

Dated 11th April, 1856.

867. Thomas Williams Makin, Longsight, near Manchester, and John Barnsley, Stockport—Improvements in machinery or apparatus for embossing moiré antique water on all kinds of woven fabrics.
869. James Burnside, 43, Henry-street, Sunderland—Improvements in apparatus for propelling and steering ships and boats.
871. George Jackson, Bilston—Improved steam-boiler, to be heated by the waste heat of puddling or mill furnaces.
873. Antoine Perpigna, Paris—Improvements in the manufacture of coke. (A communication.)

Dated 12th April, 1856.

875. Ludwig Schultz, Green-street, Stepney—Improvements in obtaining photographic pictures upon paper, glass, metal plates, and other fibrous substances.
877. William Bragg Flint, Birmingham—Improvements in fastenings for shutters, windows, doors, and such like purposes, and which said fastening is also applicable to the coupling of railway carriages and trucks, and other useful purposes.
879. Robert Baird Lindsay, Mill Wall Brewery, Poplar—Improvement in romoving the scale or deposit from tubular flues of steam boilers.

Dated 14th April, 1856.

881. George Braden and Charles Braden, Sharp's-alley—Improvements in the manufacture of show tablets for advertising purposes.
883. John Symonds and Thomas Mara Fell, Sufferance Wharf, Millwall, Poplar—Improvements in the reduction of gold, silver, and other ores.
885. George Davies, 1, Serle-street, Lincoln's-inn—Improvements in the method of soldering or uniting cast iron. (A communication.)
887. Jesse Bridgwood, Burslem—Improvement in the manufacture of china and earthenware plug wash-hand basins. (A communication.)
889. Samuel Cunliffe Lister, Bradford—Improvements in spinning.
891. Samuel Cunliffe Lister, Bradford—Improvements in weaving.
893. Alfred Vincent Newton, 66, Chancery lane—Improved machinery for felting hat bodies. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

Sealed April 25th, 1856.

2398. Henry Wyatt.
2406. John James Speed, jun.
2414. William Hartley.
2431. Richard Pannell Forlong.
2437. George Milner.
2447. Isham Biggs and Henry Forfar Osman.
2466. William Gardner.
2476. Francis Hawkes, sen.
2502. William Kenworthy.
2552. Julius Homan.
2553. John Wilkinson, sen., and John Wilkinson, jun.
2562. Thomas Skinner.
2567. Charles Goodyear.
2578. William Lea.
2612. Alfred Vincent Newton.
2620. Oliver Maggs.
2622. Coleman Defries.
2694. William Irlam.
2736. William Beatson.
2739. William Henry Smith.
2815. Alphonse Louis Poitevin.
2816. Alphonse Louis Poitevin.
358. George Tomlinson Bousfield.
388. Charles Cowper.
450. James Diment.
496. Isaac Reckitt, George Reckitt, and Francis Reckitt.
540. James Wallace, jun.

Sealed April 29th, 1856.

2413. Germain Jean Paul Marie Villeroux.
2417. Paul Emile Chappuis.
2424. Robert Griffiths.
2435. Henry Laxton.
2440. John Pinches.
2450. John Patterson.
2458. James Eastwood.
2460. George Davis.
2462. William Robertson and James Henry.
2474. John Hicks.
2506. John Wakefield.
2519. Cullen Whipple.
2643 John Henry Hutchinson.
2679. John Henry Johnson.
2711. Sir Charles Edward Grey.
2719. William Rowan.
87. William Smith.
203. John Beads.
233. Henry Samuel King.
301. Edwin Clark.
325. Thomas Frederick Tyerman.
369. William Edward Newton.
371. Alfred Vincent Newton.
386. William Watson Hewitson.
405. Alfred Vincent Newton.
419. Charles Scott Jackson, Lt. R.N.
460. Edward Schischkar.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

April 21st.

989. Charles Léon Desbordes.
1131. Conrad William Fluzel.

April 22nd.

1027. Alfred George Anderson and John Barker Anderson.

April 23rd.

984. James Napier.
1005. William Johnson.
1023. William Reid.

April 24th.

1030. Edward Bird.

April 26th.

1029. John Hetherington.
1130. William Boggett and George Brooks Pettit.

April 28th.

1034. Sir John Scott Lillie, C.B

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register	Date of Registration.	Title.	Proprietors' Name.	Address.
3830	April 17.	Parts of a Gas Governor	William Sugg	19, Marsham-street, Westminster.
3831	April 17.	Part of a Vesuvian Case or Box	J. Palmer and Son	Camberwell.
3832	April 29.	Thompson's Pocket Protector	Robert Thompson	De Beauvoir Town.

Journal of the Society of Arts.

FRIDAY, MAY 9, 1856.

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 7, 1856.

The Twenty-first Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 7th inst., John Thwaites, Esq., Chairman of the Metropolitan Board of Works, in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Daines, John Benjamin.
Dunn, Thomas.
Eagland, Thomas.
Edgington, Benjamin.
Hanmer, Lieut. F. H.
Harvey, Capt. John, R.N.
Niblet, Alfred Newsom.
Sharer, Thomas.
Warren, Henry George.
Wilkinson, George.

The following Institution has been taken into Union since the last announcement:—

414. Swanage, Literary and Scientific Institution.

Previous to the reading of the Paper the Secretary called attention to some specimens prepared by Barratt's patent process for hardening and preserving soft stone, &c. The process consists in filling the pores of soft stone and other bodies of a like nature with preparations of sulphur under heat. Caen, Bath, and other soft stones, being first worked and carved, can be hardened and made weather-proof, and it is said, at a small cost. The stone thus prepared has the advantage of preserving its tint uninjured by damp or a smoky atmosphere. Modifications of this process, whereby the stone or other material is coloured by chemical preparations, as well as hardened, produce representations of black, purbeck, and other marbles, suited for interior decorative purposes, and various compositions, when moulded and submitted to the process, can at a low cost be used instead of stone. Bronze can also be imitated, so that it requires an experienced eye to detect the imitation. A solution of sulphur and gutta percha may be applied to the exterior of buildings constructed of soft stone or other porous materials, so as to harden and render them durable and waterproof. This solution is applied somewhat in the manner of a paint, and in a short time after application it becomes hard, without discolouring the material.

The paper read was—

FIRES: THE BEST MEANS OF PREVENTING AND ARRESTING THEM; WITH A FEW WORDS ON FIRE-PROOF STRUCTURES.

By James Braidwood, Assoc. Inst. C.E., Superintendent of the London Fire Brigade.

I have been requested by the Council of the Society of Arts to send them some information as to "Fires: the best means of preventing and arresting them; with a few words on fireproof structures." It is with great diffidence that I attempt a subject of such importance to the community, not only from my inability to do it justice in writing, but from the excessive difficulty of making each person comprehend the necessity of being sufficiently careful, due care being the best prevention against fire, as well as against many other evils.

To prevent fires it is necessary to consider what are the principal causes of such calamities. These may be classed under several heads:—

1. Inattention in the use of fires and lights.
2. Improper construction of buildings, &c.
3. Furnaces or close fires for heating buildings, or for mechanical purposes.
4. Spontaneous ignition.
5. Incendiarism.

There is little to be said on the first head which is not well-known to most masters of houses or other establishments, but the difficulty is, to keep up their attention or that of those under them. Some years ago, upwards of £100,000 were lost, through the partner of a large concern lighting gas with a piece of paper, which he threw away, and thus set fire to the premises, although it was a strict rule in the place that gas should only be lighted with tapers, which were provided for that purpose. In one department of a great public institution, it was, and is still, a rule that only covered lights should be carried about, and for that purpose four lanterns were provided; yet, on inquiry some time back, it was found that only one was entire, the other three being broken—one having lost two sides and the top; still they were all used as covered lights.

The opportunities for inattention to fires and lights are so various that it is impossible to notice the whole. Incautiously approaching window and bed curtains with a light, and airing linen before the fire, are almost daily causes of fire in London, and some of the most distressing cases of loss of life have originated from these and similar causes. Children playing with fire is also another constant cause of fire, and frequent loss of life. The dresses of females taking fire adds very much to the list of lives lost by fire, if it does not exceed all the other causes put together. Taking off the burning coals from a fire, and laying them on the hearth, also causes fires occasionally. Reading in bed by candle-light is another source of the same evil. A very serious annual loss is also caused by want of due care in hanging up or removing the goods in linen-drapers' shop windows when the gas is burning. Flues taking fire often result in mischief, and it is believed that many serious fires have arisen from this cause, which can hardly be called accidental, as if flues are properly constructed, kept moderately clean, and fairly used, they cannot take fire.

From what has been said, it will be seen that care and attention may do a very great deal towards the prevention of fire, and consequent loss of life. It is very easy to make good rules, and keep them for a time, after having been alarmed by some serious loss of property or life, but the difficulty is to maintain constant attention to the subject. The most evident plan for effecting this seems to be, for the masters thoroughly to examine and consider the subject at certain stated periods, not too far apart, and to constantly warn their domestics, workmen, or others, of the danger of the improper use of fire and lights.

One of the greatest preventives of carelessness in the use of fires and lights would be a legal inquiry in every case, as it would not only show the faults that had been committed, and thus warn others, but the idea of being exposed in the newspapers would be another motive for increased care. This plan has been adopted in New York, and the reports of the proceedings of Mr. Baker, the "Fire Marshall," show that the inquiries there made have led to most useful results. Mr. Payne, the coroner, held inquests on fires in the City some years ago, but the authorities would not allow his expenses, and, therefore, they were given up, although believed to be highly advantageous in explaining accidental and other causes of fire.

The improper construction of buildings more generally assists the spread than is the original cause of fires, although laying hearths on timber, and placing timber too near flues, are constant causes of fire, and it is believed that many melancholy occurrences have arisen from these and similar sources. It is true the Building Act forbids all such proceedings, but the District Surveyors do not seem to have sufficient power, or be able to pay sufficient attention to such matters, as they are constantly met with at fires. A very flagrant case of laying a hearth on timber was lately exposed by a fire in the City. Due notice was given of the circumstance, but no further attention was paid to the matter than to make the proprietor construct the floor properly, although the Act gave power to fine for such neglect. This omission is to be regretted, as there could not have been a better case for warning others; it occurred in a very large establishment, and the work was done by one of the first builders in the City. Had this fire taken place in the night and gained some head, it would have been very difficult to have ascertained the cause. As the premises were situated a serious loss of life might have occurred, the apartment in which the fire originated being the only means of retreat which 10 or 12 female servants had from their bed-rooms.

The Building Acts, up to about the year 1825, by insisting upon party walls and other precautions, were invaluable for the prevention of the spread of fires. By them no warehouse was permitted to exceed a certain area. From the year 1842, the area has been exchanged for a specified number of cubic feet. But since 1825, a class of buildings has arisen of which there are now considerable numbers in the City, called Manchester or piece goods warehouses, which somehow, up to the 1st of January last, have been exempted from the law restricting the extent of warehouses, on the plea that they are *not* warehouses, because "bulk is broken" in them, although it is thoroughly understood that the legislature intended by the Act to restrict the amassing such a quantity of goods under one roof as would be dangerous to the neighbourhood.

It is necessary to state here, that the intensity of a fire, and the risk of its extending to other buildings, depends, *cæteris paribus*, on the cubic contents of the building which takes fire. Manchester and piece goods warehouses have for some time past been built of unlimited size, sometimes equal to twenty average houses. This is pretty nearly the same as if that number of houses were built without party walls, only that it is much worse, for the whole mass generally communicates by well holes and open staircases, and thus takes fire with great rapidity, and, from the quantity of fresh air within the building, the fire makes much greater progress before it is discovered. By this means the risk of fire in the City has been greatly increased, not only to such warehouses themselves, but to the surrounding neighbourhood, for it is impossible to say how far fires of such magnitude may extend their ravages under untoward circumstances, there being at present no preventive power in London capable of controlling them. To provide such a power would be a very costly business.

Such buildings are also against the generally received rule, that a man may burn himself and his own property, but he shall not unduly risk the lives and property of his neighbours.

The Building Act, which became law on the 1st January last, is likely to repress, to a certain extent, this great evil, unless its meaning be subverted by some such subterfuge as destroyed the efficiency of the last one. But what is to be done with those which are already built? It may seem tedious to dwell so much on this subject, but it appears to be a risk which is not generally much thought of, though it is of the most vital importance to the safety of London. It is very desirable that the metropolis should take warning by the experience of Liverpool, without going through the fiery ordeal which the latter city did.

From 1838 to 1843, £776,762 were lost in Liverpool by fire, almost entirely in the warehouse risks. The consequence was, that the mercantile rates of insurance gradually rose from about 8s. per cent. to 30s., 40s., and, it is said, in some cases, to 45s. per cent. Such premiums could not be paid on wholesale transactions, therefore, the Liverpool people themselves obtained an Act of Parliament, 6 and 7 Vic., cap. 109, by which the size and height of warehouses were restricted, party walls were made imperative, and warehouses were not allowed to be erected within 36 feet of any other warehouse, unless the whole of the doors and window shutters were made of *wrought iron*, with many similar restrictions. This Act applied to warehouses already built as well as to those to be built, and any tenant was at liberty, after notice to his landlord, to alter his warehouse according to the Act, and to stop his rent till the expense was paid. Another Act, 6 and 7 Vic., cap. 75, was also obtained, for bringing water into Liverpool for the purpose of extinguishing fires and watering the streets *only*. It is supposed that the works directed, or permitted by these two Acts, cost the people of Liverpool from £200,000 to £300,000. Shortly after these alterations had been made, the mercantile premiums again fell to about 8s. per cent.

There is another very common cause of fire, which seems to come under the head of construction, viz., covering up a fireplace when not in use with wood or paper and canvass, &c. The soot falls into the fireplace, either from the flue itself, or from an adjoining one which communicates with it. A neighbouring chimney takes fire; a spark falls down the blocked up flue, sets fire to the soot in the fire-place, which smoulders till the covering is burned through, and thus sets fire to the premises.

The danger from furnaces or close fires, whether for heating, cooking, or manufacturing purposes, is very great, and no flue should be permitted to be so used, unless it is prepared for the purpose. The reason is, that in a close fire the whole of the draught must pass through the fire. It thus becomes so heated that, unless the flue is properly built, it is dangerous throughout its whole course. In one instance of a heating furnace, the heat in the flue was found to be 300°, at a distance of from 40 to 50 feet from the fire. In open fireplaces the quantity of cold air carried up with the draught keeps the flue at a moderate heat, from the fire upwards, and unless the flue is allowed to become foul, and take fire, this is the safest possible mode of heating.

Heating by hot air, steam, and hot water are objectionable. First, because there must be a furnace and furnace flue, and the flue used is generally that built for an open fire only. And second, the pipes are carried in every direction, to be as much out of sight as possible. By this means they are constantly liable to produce spontaneous ignition, for there appears to be some chemical action between heated iron and timber, by which fire is generated at a much lower temperature than is necessary to ignite timber under ordinary circumstances. No satisfactory explanation of this fact has yet been given, but there is abundant proof that such is the case. In heating by hot water pipes, those hermetically sealed are by far the most dangerous, as the strength of the pipes to resist the pressure, is the only limit of the heat to which the water and of course the pipes may be raised. In some cases a plug of metal which fuses at 400° is put into the pipes, but the heat to which the plug is exposed will depend very much on where it is placed, as, however great may be the heat of the exit pipe, the return pipe is comparatively cool. But even where the pipes are left open, the heat of the water at the furnace is not necessarily 212°. It is almost needless to say that 212° is the heat of boiling water, under the pressure of one atmosphere only; but if the pipes are carried sixty or seventy feet high, the water in the furnace must be under the pressure of nearer three atmospheres than one, and, therefore, the heat will be proportionately increased. Fires from pipes for heating by hot water have been known to take place within twenty-four hours after first heating, and some after ten years of apparent safety.

The New Building Act prescibes rules for the placing steam, hot air, and hot water pipes at a certain distance from timber, but as it must be extremely difficult for the District Surveyors to watch such minute proceedings, it becomes every one who is anxious for safety, to see that the District Surveyors have due notice of any operation of this kind.

Another cause of fire which may come under this head is, the use of pipes for conveying away the products of combustion. Every one is acquainted with the danger of stove pipes, but all are not perhaps aware that pipes for conveying away the heat and effluvia from gas burners, are also very dangerous, when placed near timber. It is not an uncommon practice to convey such pipes, between the ceiling and the flooring of the floor above. This is highly dangerous. Gas burners are also dangerous when placed near a ceiling. A remarkable instance of this took place lately, where a gas burner set fire to a ceiling 28½ inches from it.

Another evil of furnaces is, that the original fireplace is sometimes not large enough to contain the apparatus, and the party wall is cut into. A most melancholy loss of life took place from this cause last winter. Perhaps it may be necessary to notice at this point, the use of gas, as it is becoming so very general. Gas, if carefully laid on, and properly used, is safer than any other light, so far as actually setting fire to anything goes, but the greater heat given out so dries up any combustibles within its reach, that it prepares them for burning, and when a fire does take place the destruction is much more rapid than in a building lighted by other means. Gas stoves also, from the great heat given out, sometimes cause serious accidents; in one instance, a gas stove set fire to a beam through a two-and-half inch York landing, well bedded in mortar, although the lights were five or six inches above the stone. This is mentioned to show that gas stoves require quite as much care as common fires. The heat given out by the gas also increases very much the risk of spontaneous ignition. This is believed to be a very fruitful cause of fires; but, unless the fire is discovered almost at the commencement, it is difficult to ascertain positively that spontaneous ignition has been the cause. Spontaneous ignition is generally accelerated by natural or artificial heat. For instance, where substances liable to spontaneous ignition are exposed to the heat of the sun, to furnace flues, heated pipes, or are placed over apartments lighted by gas, the process of ignition proceeds much more rapidly than when in a cooler atmosphere. Sawdust in contact with vegetable oil is very likely to take fire. Cotton, cotton waste, hemp, and most other vegetable substances are alike dangerous. In one case oil and sawdust took fire within sixteen hours; in others, the same materials have lain for years, until some external heat has been applied to them. The greater number of the serious fires which have taken place in Railroad stations in and near London, have commenced in the paint stores. In a very large fire in an oil warehouse, a quantity of oil was spilt the day before and wiped up, the wipings being thrown aside. This was believed to have been the cause of the fire, but direct proof could not be obtained. Dust bins also very often cause serious accidents. In one instance, £30,000 to £40,000 were lost, apparently from hot ashes being thrown into a dust bin.

These accidents may in a great measure be avoided by constant care and attention to cleanliness, and where paints and oils are necessary, by keeping them in some place outside the principal buildings. Dust bins should as much as possible be placed in the open air, and where that cannot be done, they should be emptied once a day. No collections of rubbish or lumber of any sort should be allowed to be made in any building of value.

Mr. Wyatt Papworth, architect, has published some very interesting notes on spontaneous ignition, giving several well-authenticated instances.*

Incendiarism may be divided into three sorts—malicious, fraudulent, and monamaniac. Of the former there has been very little in London for many years. The second, however, is rather prevalent. The insurance offices, which are the victims, protect themselves as well as they can, but an inquest on each fire is the true mode of lessening the evil. This is much more the interest of the public than at first seems to be the case. In several instances where the criminals were brought to punishment by Mr. Payne's inquests, people were asleep in the upper parts of the houses set fire to, and in one case there were as many as 12 or 15 persons. This, however, is seldom stated in the indictment, as if it is, the punishment is still death by the law, and it is supposed that a conviction is more easily obtained by the capital charge being waived. Monomania is a rare cause of incendiarism, but still several well certified cases have occurred in which no possible motive could be given. In one instance a youth of 15 set fire to his father's premises seven times within a few hours. In another, a young female on a visit, set fire to her friend's furniture, &c., ten or eleven times in the course of one or two days. In neither case could anything like disagreement or harshness be elicited, but the reverse. In other instances it has been strongly suspected that this disease was the cause of repeated fires, but there was no positive proof. In all these cases, known or suspected, the parties were generally from 14 to 20 years of age.

The best means of arresting fires is a very wide question, as the only limit to the means is the expense. Different nations have different ways of doing the same thing. On the continent generally, the whole is managed by government, and the firemen are placed under martial law, the inhabitants being compelled to work the engines. In London, the principal means of arresting fires is a voluntary association of the insurance companies, without legal authority of any sort, the legal protection by parish engines being, with a few praiseworthy exceptions, a dead letter.

In Liverpool, Manchester, and other cities, the extinction of fires by the pressure of water only, without the use of fire-engines, is very much practised. The advantages of this system are very great; but, to enable us to follow this system, the whole water supply of London would require to be remodelled.

In America, the firemen are generally volunteers, enrolled by the local governments. They are exempt from other duties, or are entitled to privileges, which appears to satisfy them, as the situation of fireman is eagerly sought in most of the American cities.

Which is the best of these different modes it is difficult to say; perhaps each is best suited for the place where it exists.

On the first discovery of a fire, it is of the utmost consequence to shut, and keep shut, all doors, windows, or other openings. It may often be observed, after a house has been on fire, that one floor is comparatively untouched, while those above and below are nearly burned out. This arises from the doors on that particular floor having been shut, and the draught directed elsewhere. If the fire appears at all serious, and there are fire-engines at a reasonable distance, it is best to await their arrival, as many buildings have been lost from opening the doors, and attempting to extinguish fires with inadequate means. If no engines are within reach, it is well to keep a hand-pump. If that is not to be had, the next best thing is to collect as many buckets outside the room on fire as can be obtained, keeping the door shut; then creep into the room on the hands and knees (if the heat and smoke are considerable), and throw the water as nearly in the direction of the fire as possible, keeping the door shut while more water is being collected. The police of the metropolis understand shutting up fires so well, that they have in many instances kept fires two or three miles distant from the engine stations shut up till the firemen arrived in time to extinguish them.

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* C. and E. Layton, 150, Fleet-street.

The description of fire-engines found to answer best in the metropolis are those with 7-inch barrels and 8-inch stroke, throwing, at the ordinary rate of working, about 90 gallons of water per minute. If a larger engine is thought desirable, two of these can be easily joined together in one stream, giving 180 gallons per minute. This size is preferred, because the weight, with hose, implements, firemen, and driver, is about 30 cwt., which is as much as two fast horses can manage for a distance under six miles. It is not often that the engines are required to travel further than this; when they are, four horses are used.

For some years past, a hand-pump has been carried with each engine. They have been found of the greatest service in keeping doors, windows, &c., cool. They throw from six to eight gallons per minute, to a height of from thirty to forty feet, and can be used in any position. The idea of the hand-pumps was taken from the old-fashioned squirt, or "hand-engine."

The Committee for managing the London Fire-engine Establishment have lately turned their attention to steam-floating fire-engines. The first trial was to alter one of the floats previously worked by manual labour. This was found to answer so well, giving 700 gallons of water per minute (ordinary rate of working), under a pressure of 70 or 80 lbs. on the square inch, that another was constructed capable of throwing 1,400 gallons per minute, and of moving at the rate of eight miles per hour, propelled by the reaction of two jets of 10-inch diameter each, driven by one of Mr. Appold's pumps.

The firemen are drilled first daily, and then two or three times a week, for some months; and this, with an average of three calls a day, soon makes them acquainted with the routine of their business; but it takes years of constant work to make a thoroughly good fireman.

The main rule to be observed is to get as near the fire, with the branch* INSIDE the building, as possible, so that *the water may strike the burning materials*. If this cannot be done, the probability is that the building which takes fire will be lost. This is not so dangerous an operation as it appears (unless the building is supported on cast-iron, of which more hereafter), as, if the building is of the ordinary strength, the fire requires to burn some time before the building is so weakened as to give way. The firemen require some practice to be convinced of the advantage of this proceeding; not that there is any trouble in pressing them forward, the difficulty rather being to keep them back; but it is much pleasanter to show off the power of their engines outside, than to proceed, perhaps on their hands and knees, amid smoke, heat, and a deluge of water, no one being able to see or value their exertions excep their own officers.

The firemen in London being constantly employed on weekly wages, give their whole time to their employers, and are much more under command than where men are only occasionally employed. The wages and treatment being liberal, although the discipline is severe, there are generally a considerable number of candidates for each vacancy. Thus good men are obtained, seamen being preferred, as they are taught to obey orders, and the night and day watches, and the uncertainty of the occupation, are more similar to their former habits than to those of other men of the same rank in life. The large number of fires, is, however, the principal cause of any advantage the London firemen may possess over those of smaller places, and it is hardly fair to compare firemen who have only an opportunity of attending one or two fires in a week to those who attend nearly three fires a day.

The supply of water is the most vital part of any exertions towards extinguishing fire. Where the pressure is sufficient, and the mains large enough, by far the most economical mode of using the water is to attach the hose directly to the mains. In London, however, that can rarely be done, for several reasons. The greatest number of plugs are on the service pipes, that is, the pipes for supplying water for domestic and other purposes, which are only open a short time every day. If the cisterns are nearly empty, the pressure cannot be obtained till they are filled. Then, again, the plugs being some distance apart, it is difficult to obtain a sufficient number of jets. But when the plugs are full open 1¾ diameter, a sufficient quantity of water is obtained from each to supply three engines, each of which will give a jet equal to the plug if confined to one jet. The pressure also in the mains in London seldom exceeds 120ft. at the utmost. For these reasons the pressure from the mains is seldom used till the fire is checked, when the ruins are cooled by the "dummies," as the jets from the mains are named by the firemen.

London is, upon the whole (except in the warehouse districts), fairly supplied with water for the average description of fires, that is, where not more than five or six engines are required. When, however, it is necessary to work ten or twelve engines, there is very often a deficiency. In New Cannon-street, where some of the largest warehouses have lately been built, except at the crossings of the old streets, there is only a 4½-inch service pipe. In other warehouse districts the supply is very limited indeed, although it is amongst the warehouses that the largest fires take place.

The water companies are generally willing to give any quantity of water, but they object to lay down large mains without any prospect of remuneration. The warehouse keepers decline to be at the expense of laying the pipes, and there the matter seems to rest. In most other places of importance, the water is under the management of the civic authorities, and they, of course, endeavour to obtain a good supply of water at fires in warehouse as as well as in other districts.

What is "Fireproof Construction?" is a question which has given rise to a great deal of discussion, simply, as it appears to me, because the size of the buildings and the quantity and description of the contents have not always been taken into account. That which may be perfectly fireproof in a dwelling house, may be the weakest in a large warehouse. Suppose an average sized dwelling house 20 X 40 X 50 = 40,000 cubic feet, built with brick partitions, stone or slate stairs, wrought iron joists filled in with concrete, and the whole well plastered. Such a house will be practically fireproof, because there is no probability, that the furniture and flooring in any one room would make fire enough to communicate to another. But suppose a warehouse equal to twenty such houses, with floors completely open, supported by cast iron pillars, and each floor communicating with the others by open staircases and wells; suppose, further, that it is half filled with combustible goods, and perhaps the walls and ceilings lined with timber. Now, if a fire takes place below, the moment it bursts through the upper windows or skylights, the whole place becomes an immense blast furnace; the iron is melted, and in a comparatively short time the building is in ruins, and it may be the half of the neighbourhood destroyed. The real fireproof construction for such buildings is groined brick arches, supported on brick pillars only. This mode of building, however, involves so much expence, and occupies so much space, that it cannot be used with advantage. The next best plan is to build the warehouses in compartments of moderate size, divided by party walls and double wrought iron doors, so that if one of these compartments takes fire, there may be a reasonable prospect of confining the fire to that compartment only. Again, cast iron gives way from so many different causes, that it is impossible to calculate when it will give way. The castings may have flaws in them; or they may be too weak for the weight they have to support, being sometimes within 10 per cent., or less of the breaking weight. The expansion of the girders may thrust out the side walls. For instance, in a warehouse 120 feet X 75 feet X 80 feet, there are three continous rows of girders on each floor, with butt joints; the expansion in this case may be 12 inches. The tie rods to take the strain of the flat arches must expand and become useless, and the whole of the lateral strain be thrown on the girders and side walls, perhaps weak enough already. Again, throwing cold water on the heated iron may cause an immediate fracture. For these and similar reasons, the firemen are not permitted to go into warehouses supported by iron, *when once fairly on fire*.

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* The branch is the metal piece screwed on to the end of the hose, carrying at its termination the jet.

To show the effect of fire on iron a few specimens are laid on the table, viz.:—

Nos. 1, 2, and 3.—Three specimens of iron from the engineers' workshops of Messrs. J. Scott Russell and Co., Millwall, 10th September, 1853.

No. 6.—Specimen of slate from the same place.

Nos. 7, 8, 9, and 10.—Specimens of iron from a fire in Covent Garden Theatre, 5th March, 1856.

Nos. 11 and 12.—Specimens of slate from the same place.

No. 13.—Brick and slate from the same place.

Nos. 14 and 15.—Specimens of iron from the fire in the saw mills of J. Scott Russell and Co., Millwall, 12th March, 1856.

The effect of fire on cast iron, as stated by Mr. Fairbairn, F.R.S., of Manchester (7th Report of the British Association, 1837, vol. 6, p. 409), is, that the loss of strength in cold blast cast iron, in a variation of temperature of from 26° to 190° = 164° Fahr., is 10 per cent., and in hot blast, at a variation of from 21° to 169° Fahr., is 15 per cent. Now if the loss of strength advances in any thing like this ratio, the iron will be totally useless as a support long before the fusing point is attained.

It is sincerely to be hoped that the clause in the new Building Act, restricting the size of warehouses, may be more successful than its predecessor, for it is not only property that is at stake, but human life. In many of these "Manchester warehouses" there are 50, or 100 and upwards of warehousemen and servants sleeping in the upper floors, whose escape in case of fire would be very doubtful, to say the least of it.

Covering timber with sheet iron is very often resorted to as a protection against fire; but Dr. Faraday, Professor Brande, Dr. D. B. Reid, and Mr. W. Tite, M.P., are of opinion that it may be useful against a sudden burst of flame, but that it is worse than useless against a continued heat. Even cast-iron, one inch thick, laid on tiles and cement three inches thick, has allowed fire to pass through both, to the boarding and joisting below, merely from the fire in an open fireplace being taken off and laid on the hearth. This arises from iron being so good a conductor that, when heat is applied to it, it becomes in a very short time nearly as hot on the one side as the other. If the smoke escapes up a chimney, or in any other way, there may be a serious amount of fire before it is noticed.

The statistics of fires are much too voluminous for such a paper as this, especially as they have been repeatedly printed already. Mr. Baddeley has, for upwards of twenty-three years, sent the annual list of fires to the *Mechanics' Magazine*, and his mode of treating the subject is very interesting. In the *Quarterly Review* for December, 1854, there is a very elaborate statement of the whole subject, condensing the Reports of Fires in London for twenty-one years.

I may mention, in conclusion, that fires in London have been doubled since the commencement of the Fire Brigade in 1833; and not only are the "calls" doubled, but the fires at which it is necessary to put engines to work have increased in a much greater ratio, being nearly three times the number they were twenty-three years ago.

Many reasons have been given for the increase in the number, as well as in the serious damage caused by fires of late years. It appears to me that the many improved modes of heating, and the general use of gas, render spontaneous ignition much more common than formerly, and, when premises do take fire, cause the fire to proceed much more rapidly. In 1833, of the number of premises which took fire, barely 21 per cent. (20.9) used gas; while, in 1855, gas was used in upwards of 67 per cent. of the buildings which took fire.

DISCUSSION.

Mr. **Sibley**, in a note to the Secretary, after regretting his inability to be present at the discussion, says, "I beg to adduce one fertile source of fires, that is, the fixing of the boiler furnaces of steam-engines, and other furnaces and close fires, against party walls, in which wood plates and bond timber are not unfrequently found. Under the Act of 1844, a clear space of six inches was made imperative, between the setting of the furnace and the party wall. Under the present Act they are subject to *no* restric tion or regulation whatever. The only difficulty to be overcome is, the wedded habit of building to this mode, and the trouble that anything apparently new involves. The disuse of bond timber and plates altogether; the introduction of iron hoop bond, and stone templates in their place; the building of cross walls, in lieu of hollow wood partitions, would tend much to diminish the hazard of fire. Wrought iron brestsummer girders should also take the place of wood brestsummers; when these are burnt through, it is manifest that the whole superincumbent mass of brickwork has nothing for its support."

Mr. **Chadwick**, C.B., said that the Society would, no doubt, appreciate highly the precautionary admonitions, as well as the suggestions of structural arrangements for the prevention of calamities, communicated that night from a gentleman to whom was due the example of a centralised and well managed establishment, which contrasted with the numerous separate establishments of the parochial, or so called local self-governments. He (Mr. Chadwick) had had occasion to examine the administrative arrangements for the repression of fires in the metropolis, as well as in other places. He had found that there were in the metropolis 150 separate parochial fire-engines and stations, and only 17 engines or land stations of the Fire Brigade; yet, notwithstanding that the relative proximity of the separate locally managed engines, as compared with those of the central establishment, might be stated to be as the relative numbers, or almost nine to one, yet in two fires out of every three, the engines of the centralised and systematised establishment were the first on the spot, and the relative efficiency of their action when on the spot need not be described. But, quick as they were, or could be, he yet found them to be deplorably too slow. Mr. Braidwood had admitted in his testimony that in the great majority of instances, that is, when the fire had got hold of the premises, it was a waste of power to attempt to save the premises where the fire broke out, and that its best application was in preventing its extension to the premises contiguous. He (Mr. Chadwick) had got the police to note the time which elapsed between the first alarm of fires and the arrival of the engines; and the return upon the first group of observations was 36 minutes. It appeared that the engines traversed the streets, allowing for obstacles, at a rate of 10 miles an hour. Information would be conveyed to the stations of the brigade at a rate of five miles an hour. In the case of the occurrence of a fire within a mile of the station, the information would be conveyed in twelve minutes; the horses would be put to and the engine got out in about five minutes on the average; it traversed the distance and arrived at the fire in about six minutes more; the water had to be got and got into the engine, which would occupy about five minutes; making about twenty-eight minutes; or, for a half mile distance, an average of not less than 20 minutes, which must occur under the most favourable circumstances. This arrangement he could not but consider as fatally too slow. A pail-full of water might suffice within the first minute, after ignition; in the second minute more than a ton weight would be required. In respect to fire-escapes, Mr. Braidwood himself had testified that they would seldom be of use unless they were on the spot within five minutes after the alarm was given. On an impartial consideration of the facts, he was confident that practical concurrence would eventually be given to the conclusion at which he had arrived, that the principle of all future arrangements for the repression of fires must be a constant supply of water kept at high pressure night as well as day, and the direct application of it from the mains before the door by means of a hose and jet. By that arrangement he had proved, that a power equivalent to three or four of the best engines might be kept constantly before each door ready for application within two minutes. Having been consulted on the subject by Mr. Edward Rushton, the late benevolent stipendiary magistrate of Liverpool, and having learned of the corroborative example of the use of water direct from the mains, first for the cleansing of the streets and houses at Philadelphia, and then for the extinction of fires, he (Mr. Chadwick) gained his advocacy of the plan at Liverpool. When, upon his advice, Mr. Rushton proposed it to a Committee of the House of Commons, the proposal was received with laughter. The very serious effect of the conflagrations in the warehousing interests at last occasioned it to prevail in Liverpool, and, as had been stated that night, with such an effect in increased safety, as was shown in the insurance charges. In a communication to him, Mr. Newlands, the borough surveyor of Liverpool, had stated the new practice: "The mains from this reservoir under high pressure, are available over the whole of the town." "On arriving at a fire the stand pipe or pipes are put down, and the hose run off the reels in an instant, and, it may be, a dozen jets are playing, and the flames nearly extinguished before the engines have left the yard." "Serious fires are now seldom heard of, for before the flames can gain head the jets can generally be played upon them, and this is the only time that there is a chance of subduing them." The mechanical or engineering objections made to the application of the like arrangements to the metropolis, were wholly illusory. On a competent and impartial examination it would be found, that what had been done in some cities might be done with economy in the metropolis and all others. Mr. Baddeley, who had attended all the principal fires which had occurred in the metropolis during the last thirty years, and who had given anxious attention to the subject of the water supply, had testified that by arrangements which should ensure the application of water to fires within even five minutes after their commencement, the progress of two-thirds of them would be effectually arrested. Mr. William Lindley, the engineer who had rebuilt that portion of the city of Hamburgh which had been burned down, and who had stated that, in that rebuilding, he had been guided in his arrangements for house and main drainage and water supply by the principles laid down in his (Mr. Chadwick's) sanitary report, had given in respect to the arrangements of the water supply, the following testimony, which was complete and conclusive in itself:—Mr. Lindley was asked—

> "Is the jet used at Hamburgh for watering the streets? Yes; and the charge has been 1d. per foot of frontage per annum.
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> "What provision is made with the new system of works which you have laid down for the prevention of fires? The mains are large—from 6 to 20 inches diameter—constantly charged at high pressure; being supplied from the one extremity by two Cornish engines, and at the other level from a high summit reservoir kept constantly filled. Throughout the whole length of the pipeage are placed, at intervals of 40 yards, fire-plugs, of 3 inches diameter in the clear.
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> "How soon can a jet be supplied for the extinction of fires? In two minutes. The men who get paid by old custom for the use of their engines will come, though they are not wanted, but the power of eight engines may be anywhere applied, as quickly as the hose can be screwed on, and introduced *inside* the house where the fire is.
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> "Have there been fires in buildings in Hamburgh in the portion of the town rebuilt? Yes; repeatedly. They have all, however, been put out at once. If they had had to wait the usual time for engines and water, say twenty minutes or half an hour, these might all have led to extensive conflagrations.
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> "What has been the effect on insurance? The effect of the rapid extinction of fires has brought to light to the citizens of Hamburgh, the fact that the greater proportion of their fires are the work of incendiaries, for the sake of insurance money. A person is absent; smoke is seen to exude; the alarm of fire is given, and the door is forced open, the jet applied, and the fire extinguished immediately. Case after case has occurred where, upon the fire being extinguished, the arrangements of incendiaries for the spread of the fire are found and made manifest. Several of this class of incendiaries, for the insurance money, are now in prison. The saving of money alone, by the prevention of fires, would be worth the whole expense of the like arrangements in London, where it is well known that similar practises prevail extensively."

He (Mr. Chadwick) had obtained, through Mr. Braidwood, the statistical facts, that whilst, in general, of the parcels of property or tenements in the metropolis only about one-half was insured, it so happened that of the properties burned more than two-thirds were insured. The inference from this bare statistical fact of the greater danger of property after insurance, which was attributable in part to the weakness of natural motives to precaution, as well as temptations to crime, had been corroborated by the regular inquiries instituted into the causes of fires by Mr. Payne, the coroner, which the Corporation, with wasteful and characteristic parsimony, had stopped. But the men of the Fire Brigade were well aware, from circumstances which, in the absence of a system of public prosecution (and which left public companies open to the imputation of prosecuting merely for greed), that the extent of incendiarism was far greater than was displayed even by Mr. Payne's inquiries, great as that was. So great, indeed, was the proportion, that the director of one company, on hearing of a fire, and before knowing the circumstances, was accustomed to exclaim, "More incendiarism." The present state of things—the combined prevalence of defective legislative and administrative as well as of engineering arrangements, in the face of proved available means of protection—the weakening of the unconscious action of natural interests in precaution by unguarded full insurance, in contravention of the established principles of insurance—the temptation to the commission of crime by the absence of proper means for its detection and prosecution—the daily occurrence of fires in the metropolis, the number of horrible deaths from them, as well as the loss of property which they occasioned—the apparent apathy with which such calamities were regarded, and the rapidity with which they were forgotten—were deeply to be lamented, and would hereafter be referred to as evidence of a very low social condition, and of defective administrative capacity and organisation.

Mr. **John Braithwaite** could not say to whom the greater compliment was due—whether to the Council of the Society, in having requested Mr. Braidwood to indulge the Society with the valuable paper that had been read; or whether to Mr. Braidwood himself, for the able manner in which he had put together so many excellent ideas, and so much that would not end, he was certain, upon that night. It was the most valuable subject, perhaps, with the exception of one, that had ever been broached in the Society; and it was one which he had no doubt would be thoroughly sifted before the discussion terminated within those walls. The subject before them was the prevention and the arresting of fires. He arrogated a little to himself, as being what was termed one of the earliest and oldest fire-eaters; for that was the designation, not within the last few years, but something more than a quarter of a century ago; and it was a matter of great surprise to him to know that the means (his steam fire-engine) which were then practically and successfully adopted and approved by the public—by the many thousands who witnessed the experiments then tried—that in all these matters, which were carried out at his individual expense, that he was permitted to incur such an enormous outlay of money for the benefit of the community, without having received a sixpence in the shape of reward, directly or indirectly, from any one, excepting some of his servants, who, upon one occasion, were presented with a sovereign from the gentleman who sat on the left of the chairman (Mr. Braidwood), for some particular exertion at one of the fires, at which the particular means he (Mr. Braithwaite) adopted was employed. Mr. Chadwick, who was always clever, with his usual tact, in the observations he made, had told them that if they got a little water, and applied it to the fire at once, they need not give themselves the trouble to look for a great quantity of water at the last. In the early period of the building of Drury-lane Theatre, every possible means was adopted to prevent fire occurring, under his father's directions, in conjunction with Colonel Congreve and the late Mr. Whitbread. It was carried out to a perfection that was almost unheard-of, or thought to be practicable. There was not a spot in any part of that theatre but that at one moment's notice they could control any chamber, however remote or however near, by—not a deluge of water, but sufficient water at a particular moment to arrest the progress of the flames. The greatest advantages experienced, however, were from two small garden engines, that cost but £15 each, one in each fly; so that the instant there was anything like conflagration, the small branch, with a fan top to spread the water, was applied, and the fire was extinguished even whilst the performances were going on. Many times had the theatre been on fire under such circumstances, and many times successfully extinguished, with only a few gallons of water. About that period, Mr. Salmon, one of the agents of the Duke of Bedford, introduced the portable or chamber fire-engine. He (Mr. Braithwaite) was, at the time to which he alluded, an extensive manufacturer, and constructed hundreds of these little engines, at the moderate cost of £3 each. Great numbers of people availed themselves of these little portable engines, which held some four gallons of water. They were placed in the hall of their dwellings, and on the bedroom landings; and by them, he believed, many hundreds of houses had been saved from destruction by fire. Mr. Braidwood happily looked upon his fellow-creatures with the same cast-iron nerves that he possessed himself, when he told them to close the doors—to go for water—to creep cautiously into the apartment on fire—and apply the water to the particular portion on fire. Mr. Braidwood could do all that—he had seen him do it—but how many among those present would like to try the experiment. The little water was everything, if they could lay their hands upon it, even in a pint pot. In the great fire which occurred at Barclay's Brewery, all except the malt-lofts was burnt down; and he believed that he (Mr. Braithwaite) was instrumental in saving some £60,000 worth of malt. The beams had caught fire on one side of the malt-lofts; he went across one of the beams with two pint pots, and carrying a gallon of water under his arm; and by applying it in the way recommended in the paper, he extinguished the fire in the beams, and the malt was saved. He had spoken of the *little* water; he would now say a word or two with respect to the *larger* quantity. He was glad to find that in 1856 there was a little more moral courage displayed than there was in the year 1830, and from that to 1835. When he saw Mr. Braidwood there, the chief of the Fire Brigade—and, although the phrase was hackneyed, he would say, "the right man in the right place,"—when he found he came boldly forward, in spite of those who were his employers, to give information how, to the best of his judgment, as far as he might venture, to put fires out, he repeated, he was astonished, but no more astonished than delighted. He (Mr. Braithwaite) believed it was not to the interest of fire insurance companies to put out fires! He had evidence beyond any doubt on this point, and the remark which Mr. Braidwood made about legislative interference, led him to think that from that hour the legislature would look more into these matters than they had done before—the only safeguard between the public and the insurance offices—for he must tell them that in 1830, under the special request and encouragement of the insurance offices, he constructed that which would not prevent fires, but would and did extinguish them most effectually, and that was the Steam Fire engine. He (Mr. Braithwaite) first constructed an engine of 10-horse power, and he was told by the authorities it was too large, and that he would pump the Thames dry. He then constructed one more portable, of 5-horse power, with which he succeeded, without a single failure, at the numerous fires he attended. The first great exhibition of the powers of that invaluable machine, was when he had the honour of the company of the late Duke of Wellington and Sir Robert Peel, who remained with him witnessing its powers at the Argyll Rooms, when, but for that engine, he could not say but that the whole of Regent-street might have been destroyed. The ordinary fire engines were one and all frozen up on that occasion, and the steam fire engine alone was capable of being worked. The fire was extinguished, and he received congratulations not only from the public, but from the insurance companies, upon the success of the engine. He afterwards was summoned to attend several meetings of the Committee of the several Fire Insurance Companies, and after numerous attendances and promises of patronage, he was then told a secret by Mr. Jones, of the Phœnix Office—"why give Mr. Braithwaite so much trouble, when he knows it is not to our interest to have such a machine as his going about; as, if the public were aware that the Insurance Companies had such powerful means of extinguishing fires, no one would come and insure." Nothing then seemed to be wanted in the opinion of Mr. Braidwood but two classes of engines, the ordinary engines and the hand-engines. He must get more of them, and he must not put down the parish engines, and if the parishes did not provide and keep their engines in an efficient state, the legislature must interfere, and they must be brought into more extended use. He (Mr. Braithwaite) said, in 1835, "if you do not want these large engines upon land you will want them at least upon the river." He made drawings and estimates and sent them into the Committee, and after two or three weeks' consideration, he received a letter from Mr. Braidwood, stating that they had not time to take the thing into consideration at that moment, but as soon as they had, they would avail themselves of his valuable services. Now, they were told, attention had been directed to steam for a floating engine. He would ask, if the object was to put out fires, why did they not begin in 1835 as well as in 1855; therefore, he said, he was pleased in 1856 to see Mr. Braidwood come there and give them information which he (Mr. Braithwaite) felt certain he would not have communicated in 1835. They were now upon the eve of having a high-service supply of water, so that there would not be a single room in any house in which they could not obtain a continuous supply of water at all times, when by the application of a small cock and a gutta-percha pipe within the dwellings, fire engines from the outside might, perhaps, be dispensed with. There was now an Act of Parliament, which he had the honour of assisting to conduct through the House—the Metropolitan Water Act—by which water companies are obliged to supply the best filtered water under pressure from the top to the bottom of houses at any and all times. That, he thought, would be one means of averting conflagrations. The numerous fires that occurred were not matter of surprise to him, for which two principal causes might be assigned:—In the first place, the number of houses was doubled, the population was doubled, and the use of gas had multiplied in a ten thousand-fold ratio. Therefore, the number of fires in the metropolis was not surprising; and if Mr. Braidwood would impress upon those for whom he acted that it was necessary to give him the great power he would have from the application of steam to engines upon land, the same as had been done to those on the water, he could, as far as he was concerned, accomplish in the present day what was effected formerly at the Argyll Rooms, Lyceum Theatre, Barclay's Brewery, and other conflagrations.

Mr. **Hawes** regretted that the discussion upon the interesting paper which had just been read had been interrupted by the charge which the last speaker had brought against the insurance offices of this metropolis. Were no other evidence at hand to disprove his assertions, their inconsistency with his previous statements would be sufficient to do so, for was it not clear that to the combined action of the insurance offices we owed the efficiency of the Fire Brigade, and the appointment of Mr. Braidwood himself, and through him the collection of the information by which the mischievous action of fires was materially lessened. But besides this, let us look at these statements as a matter of business. How did the offices make their profits but by the premiums they received without any claims being made. Surely it would not be easy to make a profit if, after receiving a small premium, they encouraged the destruction of the property from whence their income was derived, and had, besides, to find the money to rebuild the property destroyed. To leave this part of the subject, however, he should like to inquire of Mr. Braidwood how he explained his statement that hot-water pipes, by some chemical action, when placed near wood work, caused fire.' Indeed, he was puzzled by the paper to know which was the safest mode of heating a house. Gas, it was said, was dangerous, so were open fires and close fires, and hot water and steam. He hoped, therefore, we should have something more as to which was the best and safest mode of heating our houses.

Mr. **Marrable** said his principal object in rising was to offer a few observations in refutation of the remarks made by Mr. Braithwaite, to the effect that the insurance offices rather encouraged fires, and that Mr. Braidwood was under control, so that he did not say all he could as to the readiest means of preventing and extinguishing fires. Now, so far from this being the case, Mr. Braidwood, who must be looked upon as the representative of the fire offices, was deserving of the greatest credit for the anxiety he had shown, and the intelligence with which he had brought his great practical knowledge to bear upon the subject whenever new bills had been before Parliament for regulating the construction of buildings in the metropolis. In the bill of 1844, and the present Building Act of 1855, several clauses had been introduced, he believed at the suggestion of Mr. Braidwood, for the prevention of fire, as much as possible, by disallowing the introduction of bond timber and wood bricks, and other regulations, and for arresting its progress by sub-dividing buildings by cross or party walls, when they exceeded, in cubical contents, a certain number of feet. He (Mr. Marrable) was not prepared to go quite as far as Mr. Braidwood in the regulations as to the distances at which it was now the law that all pipes for warming by hot water or steam should be fixed from any wood work, viz., three inches. When high-pressure pipes were used, the precaution was wise and necessary; but he did not think there was any occasion for such a restriction when pipes for hot water at a low-pressure only were used. He feared that such a rule might be found very difficult to carry out in all cases. He also dissented from the supposition that "a chemical action took place between heated iron and wood." He believed that the only action was, that the constant heat at last reduced the wood to a state resembling touch-wood, which was ready to take fire on the slightest accident. With regard to the difficulty of enforcing the rules respecting the laying hearths free of all timber work, it should be mentioned that the builders were bound to give notice to the district surveyors, whose business it was to enforce the rules of the act. This they were not generally backward in doing, although it was possible that some builders might manage to cover up and conceal irregular construction during the absence of the district surveyor. Moreover, there was always more or less difficulty in getting the magistrates to convict.

Mr. F. **Whishaw** remarked, that when this subject was brought before the Institution of Civil Engineers, about four years ago, it was stated in the course of the discussion that as bulkheads were useful in preventing fires extending in ships, party walls should be adopted in large warehouses, so as to divide the space and confine the fire to the spot where it originated. That suggestion was approved of by Mr. Braidwood, and also by Professor Hoskyns, the official referee of the insurance companies. He was glad to find that Mr. Braidwood still held to that opinion, and it seemed to him that in any future Acts relating to building, clauses to that effect should be introduced. He knew a warehouse in Bermondsey with an unbroken area of wooden flooring of three quarters of an acre. There were also many large granaries which might be easily divided and fire prevented from extending. Mr. Braidwood seemed to think that the large buildings in the City had been constructed without reference to such precautions. He would mention that a very efficient mode of obtaining notice of a fire breaking out was furnished by the electro-magnetic alarum, which consisted of a simple tube of mercury connected with wires attached to the alarum apparatus and battery. Upon a fire breaking out the heat caused the expansion of the mercury, by which the circuit was completed, and the electric current was enabled to pass, setting the alarum in action. He confessed he was astonished that the steam fire-engine had not been introduced into London; he was at a loss to conceive why the insurance offices had not adopted that efficient mode of extinguishing conflagrations by which hundreds of tons of water might in a short time be thrown upon the burning mass.

Mr. **Charles Mayhew** said, as he was surveyor to one of the oldest insurance companies, and a district surveyor, he could speak with some confidence on the subject brought forward by Mr. Braidwood. He begged, in the first instance, to reply to the observations made relative to the steam fire-engines. The reasons why they were not generally adopted on land was, that the large quantity of water which they could supply was not, in the generality of cases, required, inasmuch as water injudiciously applied, did, very often, more damage than the fire would if left to the judicious management of the Fire Brigade to extinguish, which was, in most cases, stopped in a way perfectly astonishing. He had now two damages in hand to make good—one to a large house in Park-lane, where the timbers of the roof caught fire through a defective flue belonging to the adjoining house. The timbers were in a blaze from one end of the roof to the other, yet the fire was extinguished by the Fire Brigade before it got through the greater portion of the slate and lead covering, and although the water had penetrated into the rooms below, yet it was not supplied in such superabundant quantities as to do any serious damage. The other instance was in Strutton Ground, Westminster, where the contents of the shop, which was filled with combustible matter, also the staircase and the two back rooms, were nearly consumed, and the two front rooms over the shop were left entire (the doors being shut), and the furniture was only slightly injured. This showed that a judicious and moderate application of water, by men who thoroughly understood the business, was far better than tons supplied by those who did not understand it. Another reason against the steam fire engine was, that it must continually have the steam kept up, otherwise it would take too long to bring it into use. As regarded the observation which had been made that fire offices did not care for fires being extinguished, he could assure the meeting that such a remark was fallacious. He (Mr. Mayhew) not only spoke as an officer, but as a large proprietor, and he could safely assert that they would call Mr. Braidwood severely to account if he were to allow fires to go beyond their justifiable limits. He had great pleasure in testifying to the efficiency of the Fire Brigade and its admirable management, and there was no want of alacrity. It certainly might be more efficient if they had more funds. As regarded the structure of buildings, he was quite persuaded that unless the legislature would adopt strong measures, fires would continue as heretofore. Houses ought to be constructed on the French system, and not as they were built here, on purpose to burn. They were piled up as the wood was placed in a grate to light a fire. The floors were wood, the partitions were wood, the stairs were wood, so put together as to be all hollow, and so connected as to allow air drafts in every direction; and oftentimes the brick walls were what were called battened, allowing air vents behind the plastering. Thus the house was on fire from top to bottom before it was known by the inmates that a fire had broken out, and the doors and windows in the surrounding walls allowed the admission of air to feed the flames. It was difficult perhaps to construct any thing fire-proof, but still it could be approximated to; it might perhaps be more costly so to build, but what was cost compared with loss of life. Speculating builders, however, would never adopt this manner of building, unless compelled by an Act of Parliament. With regard to the construction of warehouses, he did not think that anything would be effectual unless they were entirely constructed of brick, which would occupy too much room and be exceedingly inconvenient. Therefore' the only way was to confine them to a certain cubical content, as required by the present Act of Parliament. Another source of fires was using common flues for close fires; such flues were only enclosed by 4 inch brickwork, which was wholly inadequate. Another evil was using Welsh fire-lumps at the back of grates, which, if fixed close to the party wall (especially in old houses, wherein timbers where almost invariably inserted) very often set fire to the adjoining houses. He had recently met with a case of this kind. He would conclude his remarks by urging the necessity of attending to the admirable advice given by Mr. Braidwood in his paper, and by thanking him for his labours.

Mr. John W. Papworth,* F.R.I., B.A., would venture to reverse the order of the remarks made by Mr. Braidwood, so as to inquire, first, whether fire-proof buildings could be made; and found himself, with much pain, opposed in opinion—apparently, but perhaps not in fact—to the authorities named by the author of the paper just read. He put forward a contrary opinion to Mr. Braidwood's with some hesitation, because that gentleman had had the opportunity of seeing many cases of total destruction; but he was convinced that Mr. Braidwood laboured under the difficulty of condensing the materials for a large book into the limits of a paper like the present. He assumed that it would be agreed that what people called fire-proof materials were literally the least protections in a great fire. Thus, stone staircases were likely to crack at the wall, and fall, long before an equally solid wood staircase would be unsafe to the escaping occupier. Iron beams pulled the whole building down with them, whereas wooden beams, sadly charred, remained long after the engines had ceased working; and, in a great fire, even brick arches failed, and fell. He admitted that very thick arches would stand a great heat; but the little things which were now called brick arches were impotent before even a moderate fire. A friend was saying, last year, that he saw a brick-arched warehouse, belonging to his family at Liverpool, appear to melt down into the flames. Mr. Piper had observed that Yorkshire stone was exceedingly destructible by fire, and that, practically, it did not furnish a fire-proof floor; but this did not appear to be Mr. Tite's opinion. And Mr. C. H. Smith considered that concrete, properly made, would bear a very considerable degree of heat, perhaps more than Yorkshire stone. Mr. Barrett had stated that, supposing any intense degree of heat to be generated, before it would act injuriously on iron and concrete, it would, probably, quite destroy a brick arch, either by disintegration, or by the arch's own expansion. Mr. Braidwood seemed to think that the only fire-proof construction for large warehouses, where an intense degree of heat might be generated, was groined brick arching on brick piers. He (Mr. Papworth) accepted these discordant statements as evidence to one thing—viz., that none of them were fire-proof in the ordinary sense of the word; and gave great credit to Mr. Braidwood for the distinction drawn between ordinarily fire-proof, extraordinarily fire-proof, and incombustible premises. The public had certainly been misled by the scientific acceptation of common terms. Fire-proof did not mean incombustible, but only "not very likely to be totally destroyed by fire." Covering wood work with metal was allowed by the insurance offices to be a prevention to a certain extent, that is to say, if a current of air passed between the hearth and the metal that touched the wood. A stone was equally a prevention under such circumstances, but he had seen a case where the hearth touched the stone; both the hearth and the stone had cracked—merely cracked—and the floor below took fire, with no current of air between the plate or stone and the hearth. Such covering was not a certainty of prevention, and, therefore, a second shield interposed was not an extravagant precaution, but was, perhaps, the most real protection that could be given in a case where a stove must be placed upon a floor. Having gone so far, he must own that if faith was to be put in printed documents, in Acts of Parliament, in reports of experiments, in patents, and in sculptured memorials, it would seem that, in opposition to the authorities mentioned by Mr. Braidwood, wood covered with metal was as much fire-proof, as it was more economical than any mode at present put forward as a protection against fire. Mr. Papworth referred to an obelisk erected in 1776, on Putney-heath, by order of the corporation of London, to commemorate the satisfaction felt by committees of that body with experiments made in that year, and described in a pamphlet published in 1785, entitled "An account of the invention and use of fire-plates for the security of buildings and ships against fire." The author, Mr. David Hartley, was M.P. for Hull. A reprint, with additions, by his nephew, in 1834, stated that, "resistance to every possible degree of fire, such as in distiller's shops, or turpentine warehouses, may be accomplished by applying metal plates above and below the timbers, with dry sand or rubbish between them. In experiments repeatedly tried with this double application, the room was filled from the floor to the ceiling with faggots and pitch and tar. As to common dwelling-houses; when the single application of the plates was tried in the experimental house, where also air bricks were provided to the floors, the trials were continued from day to day to the same part of the ceiling and timbers of the house a great number of times after the plaster-work was burnt down and destroyed; but the timbers could never be set fire to, so as to burn of themselves, nor could the fire ever spread sideways: as long as the burning faggots were applied to the timbers, they were charred perhaps to the depth of an inch of their substance, but the plates over them acted as an unconquerable extinguisher, preventing them from taking fire and burning of themselves." Rolled copper plates were specified, as well as those of painted iron. Tinned or galvanised iron or zinc would be equally applicable. In 1774, the sum of £2,500 was voted to the inventor by Parliament; and, in 1777, the patent was extended for thirty-one years. If these statements were worth anything, it seemed extraordinary that the system should have died; and it might be desirable that the experiments should be repeated. He (Mr. Papworth) also wished to recall attention to the statements formerly made that timber and woodwork which had undergone Payne's anti-dry-rot process were uninflammable. He regretted that there was not in this country a body that would undertake the verification and comparison of such statements. By the late Building Act any metal or other pipe or funnel for conveying smoke, heated air, or steam, ought not to have been placed nearer than fourteen inches to any combustible material. But this had been constantly neglected; and in most cases, the district surveyor had never known that work of the sort was being done; consequently, he could not be blamed for accidents. By the present Act, pipes for hot water must be 3-inches, for heated air or steam must be 6-inches, and for smoke or other products of combustion must be 9-inches from any combustible material; and no ventilation opening might be nearer than 12-inches to any combustible substance. Both Acts gave a penalty of twenty pounds if the work, although correctly done, had been executed without notice given to the district surveyor; and the new Act added a penalty of twenty pounds a day after non-compliance in forty-eight hours with a notice from the district surveyor that he had discovered the fault. It remained to be seen how this portion of the new Act would succeed. Mr. Papworth believed that a long time would elapse before a sufficient number of convictions had been obtained to render the proprietors of premises more careful and more honest than they were under the old Acts, which, Mr. Braidwood observed, were frequently infringed, and by men of reputation. The new Act had provided against the future erection of such extensive buildings as Mr. Braidwood inveighed, very properly, against, under the name of Manchester or piece goods warehouses; and now no warehouse or other building wholly or in part for the purposes of trade or manufacture, was allowed to contain more than 216,000 cubic feet, which was quite large enough, for they would then be 100 feet by 40 feet by 50 feet, equal to five of the ordinary houses mentioned by Mr. Braidwood. It was remarkable that the people should risk their lives by passing every night in lodgings, or even in their own houses, with the knowledge that there was no means of escape in case of fire, except at the windows of the front, where ladders could be raised. Yet such were the persons who would calculate, upon the best grounds, how many people returned home late at night with half-closed eyes, tried perhaps three or four lucifers, blew out the light which they had ignited, and went carelessly to sleep. The new Act was intended to provide against part of this risk, by preventing any new house being erected as a lodging-house to contain more than 3,600 square feet in area, that is to say, 100 feet long by 36 feet wide, also equal to five of the ordinary houses mentioned. Mr. Braidwood had alluded to the fires which he had met with, caused by neglect or infractions of the Building Act. In justice to a much abused body of gentlemen, he must say, that architects, builders and proprietors, did very frequently, sometimes wilfully, sometimes ignorantly, sometimes carelessly, defraud the district surveyor of his fee, by not giving him notice that work was to be done. On the other hand, the district surveyor trusted a good deal to the character of the tradesman employed, as well as to the good faith of the architect, if there was one concerned; but neither the district surveyor nor the master builder considered themselves called upon to watch the action of the workmen, and it was here that the damage was done. Mr. Tite built a fire-proof Exchange with false windows in it; a bricklayer was engaged to build a flue, and made the wood frame of the sashes serve as one side of the flue which took fire. Mr. Smirke built a wall across the roof of Covent Garden Theatre; no one could tell who pulled it down or when it disappeared. In his own house the ventilating shaft of the cellars was turned into a fireplace, and in a neighbour's a fireplace was bricked up and made a packet. Such were the aids, if not the literal causes, of fires, for which the district surveyor was abused, whereas the blame rested on those who cheated him of his fees. He agreed with Mr. Braidwood as to the difficulty of maintaining the attention of masters and servants to the consideration of the subject. He thought servants and masters were almost equally blameable, but that enough had not been said as to the wilful carelessness of masters, who, as educated men, should be reasonable beings. For instance, it was well known that lime in sacks, if wetted, would set the sacks on fire, and such fires had occurred twice in the yards of houses where the masters should have known better than to allow the lime to be placed against sheds. Servants were equally concerned in the results of inattention to a light or a fire. Yet, although a fire had occurred at the next house to his own, he could not find that less inattention than usual was paid to his family advice. He believed that such inattention to fire on the part of servants as he constantly saw in the houses which he professionally entered, was the result of a belief in superior skill or wisdom of the offending party; and this was only, so far as he knew, to be cured by punishment; but the inattention frequently only exhibited itself by setting the house on fire. Mr. Braidwood's hope of preventing fires was by enlisting the active inspection of the masters; but, if his (Mr. Papworth's) view of the case was right, matters would remain just as they were. The attention of the Society might be called to a few points in gas-lighting which bore upon the subject. Too many burners were made with taps which opened both ways, and allowed a careless or nervous person to leave it open; whereas a tap made with a stop gave certainty, even to the most nervous person, that there could be no escape from that jet. The use of composition pipes in lengths, not exposed, was a source of explosion more frequently than a defective meter. The meter ought never to be *in* a building. Mr. Papworth had in his own house one which became full of little holes, as if pricked with a pin. Snakes, as the flexible tubes were called, were dangerous, as the pressure of the gas forced liquid caoutchouc out of the india-rubber tubes, which was, of course, equivalent to an escape of gas. Mr. Papworth had a gutta percha tube which took fire at the union with the lamp; but he was fortunately present while the burning gutta percha pipe was dropping on the floor. Gutta percha pipes, as sold for the purpose, did not withstand the usual pressure of gas. The bad setting of ranges and stoves was a fertile source of fire, and it was to be regretted that the new Building Act appeared to leave that point to the discretion of the surveyors of the insurance companies; also that it had not provided for the immediate division of the great buildings called by the owners themselves warehouses, which were so evidently built in evasion of the spirit and intention of the old Act. With regard to some observations made during the evening, the insurance companies would naturally feel complacent when a fire occurred, if not on property insured; the alarm produced an increased business to the offices. The companies divided large risks, both of life and fire, among themselves; they could not rejoice in each other's losses. He eulogised the manner in which the Brigade attended any fire, without stopping to ask if the building was insured; and adverted to the improbability that even when the high service water supply became the rule, the majority of houses already built and unsupplied would be furnished with it. He mentioned one case in which the bursting of a cistern on the high water service had sent 800 gallons of water down a house, destroying property by inundation to a greater extent than any fire that could have occurred there on the same day. He held that in most cases the sudden alarm would leave the inmates of a house, supplied with continual high service, as much in need of the services of the Brigade as they were at present. He bore testimony from his own experience to the rapid attendance of the Brigade at a fire next door to his own house, and remarking on the difficulty of disturbing the inmates, showed that few of the audience would have been able to have applied usefully the means which a high service would allow. He admitted the rapidity with which in Hamburgh fires might be extinguished of late years; and he described the attendance of the police at every double crossing in Paris and some French cities, with power to break open doors in case of fire; a permission given not only to the police, but to any person suspecting fire in some of the German towns, which he understood was the case also at Hamburgh. This was not the law in England, at all events in London, as the police had refused him permission to break a pane of glass, to pour a pail of water on the commencement of what he considered a case of incendiarism. With regard to the opinion of some foreign jurists on the propriety of confiscating a portion of the amount insured, Mr. Papworth explained the difference between the applicability of such a law in countries where the tenant was also the owner in almost every case, and its injustice in London, as representing England, where scarcely any house was occupied by its owner, who therefore, if he did insure, would be exposed to a certain loss by a malicious or careless tenant. He also explained that it was owing to the foresight of landlords, and not to fraudulent fires, that two-thirds, as stated, of the house property burnt in London, were found to be insured, in favour of the landlord, by the tenant.

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* It should be stated that Mr. Papworth's views are printed at greater length than the time at the disposal of the meeting permitted of their being spoken.—Sec. S. of A.

Mr. **PHILIP PALMER** was anxious to have followed Mr. Mayhew, (who was the surveyor to the fire office of which he was a director) in order to support his disclaimer of the fire offices being actuated by interested motives in the non-suppression of fires, an assertion which was disproved by the noble establishment of which Mr. Braidwood was so distinguished an officer. The way in which the remarks of Mr. Hawes and Mr. Marrable had been received by the meeting, showed that the attack on the fire offices was groundless. All who remembered the old system, while they admired the brilliant coats and badges of the firemen, must admit that the present system was far superior; perhaps from the occasional rivalry of the men in those times, who felt more interest in houses insured in their particular offices, the charge that had been made had arisen; there were no doubt many good men in those days, as there were good "Charlies" or watchmen before the new police force was introduced. The Fire Brigade was to the old system what the new police force was to the old watchmen. It must be borne in mind that the Fire Brigade was really a private establishment, being instituted by the fire offices for the protection of their insurers, although the public received as much benefit, and could, in return, only bestow their gratitude. Mr. Braidwood had alluded to the parochial system having become a dead letter, which was to be regretted, still it might be restored, and the parish engine rendered available, if not to put out a fire, to hold it in check until a larger force arrived. He would be glad to see the matter taken up by the new Metropolitan Board of Works, of which so many members were present that evening, though he did not know how far they could co-operate with the Brigade. It had been suggested that parishes might give their money, which reminded him that, some years ago, an application had been made to the parish of St. Martin's, from the Society for the Prevention of Life from Fire, for assistance, and the parish had voted ten guineas annually, an example which other parishes had followed. In such a way support might be given to the London Fire Brigade establishment. Mr. Palmer could not speak on the rendering buildings fire-proof. He was afraid that if buildings could be made so, then, indeed, fire offices would be useless. As a director, having only the interest of the contributors, the discontinuance of the fire offices could not affect him, but it might those zealous and active officers of the fire offices who he should be sorry to see thrown out of employment.

Mr. G. F. **WILSON**, F.R.S., said, Mr. Braidwood had given so many valuable suggestions, that it was difficult to add to them. There was, however, one mode of checking a fire to which he had not alluded, and which, in his (Mr. Wilson's) earlier experiences, he had found prove useful. Some of the largest fires had occurred in chemical manufactories, where coppers or other vessels containing combustible materials were set over fires in heated brickwork. In most of these factories there were steam boilers. If the simple precaution were taken of connecting a steam-pipe from the boiler to the flue round the copper, in case of a leak or other appearance of danger, on a cock being turned on, steam was admitted, which, immediately displacing the air from the flue, damped the fire. Mr. Braidwood had spoken of iron pipes being a common cause of fire. From inquiries he had lately made as to the breaking out of fires in manufactories, it would appear that clay pipes (!) were a still more frequent cause of fire. When brought in, with their contents only half extinguished, they set fire to the men's jackets, which, stowed away in corners, started a fire that might not be for some time discovered.

Mr. Hows, in allusion to the remarks of Mr. Braithwaite, said he was a holder of shares in one of the insurance companies, and to his surprise he had been told that evening it was to his interest to do something detrimental to the public good. He, however, trusted that was not the general opinion of the meeting. He had expected some more extended notice in the paper upon the subject of fire escapes—a matter in which he took a great interest. He (Mr. Hows) proceeded to state the difficulties which attended the introduction of a fire escape for the public safety in the parish in which he resided (St. Leonard, Shoreditch), and in the affairs of which he had been in the habit of taking an active part. The public auditor of the parish accounts had refused to allow the charges connected with the fire escape, as a matter which was unauthorised by the Poor Law Act, but, after some contest, fire escapes were provided. An objection had been taken that the present fire escapes were too cumbersome to be of service in courts and alleys; but he thought, amongst the scientific men now present, a machine adapted for those narrow localities might be designed; and he hoped it would have attention and be carried out.

The **CHAIRMAN** stated that the hour was arrived at which the meetings usually closed; but, as he was informed there were several other gentlemen present who were desirous of offering their remarks upon the subject, it was suggested that the discussion should be adjourned.

Mr. **NICHOLAY** said, noticing the hour, he was about to suggest an adjournment of the discussion. The subject was one in which he had always felt a deep interest, more particularly with regard to fire-proof buildings. That subject he ventured to say had not been taken up in the way he thought it ought to be; and he would put it to the meeting whether the whole subject was not of that importance to justify a resumption of the discussion on a future evening.

The meeting having unanimously pronounced in favour of adjourning the discussion,

The **SECRETARY** announced that it would be resumed on Friday evening week.

The **SECRETARY** further announced that the paper to be read on the evening of Wednesday next, the 14th instant, was "On Means available to the Metropolis and other places for the Supply of Water free from hardness and from organic impurity," by Professor Clark, M.D., of Marischal College and University, Aberdeen. On this evening John Simon, Esq., F.R.S., will preside.

The Secretary has received, since the meeting, the following remarks upon spontaneous combustion, from Mr. G. F. Ansell, who says, "Amongst the causes from which large fires resulted, Mr. Braidwood mentioned spontaneous combustion, and although not a member of your Society, I was sorry to find that no one offered any point from which to discuss this subject. As I cannot (from a previous engagement) attend the adjourned discussion, I would beg to offer a few remarks, which, should they meet your views, may possibly interest some of your members.

"Some years since Professor Dobereiner discovered that spongy platinum absorbed and condensed within its particles large quantities of oxygen, and that if a stream of hydrogen, alcohol vapour, coal gas, and sundry hydrocarbons, were allowed to flow upon this spongy platinum, a combustion ensued, evolving a very considerable heat. I do not go into details, but allude to facts for the sake of illustration. It has since been discovered that other substances possess this remarkable property, and I would now offer to explain, as no one else did, that the fact of oil and sawdust exciting combustion, may be due to this property existing at the same time with the extended surface presented by the sawdust. I have found that new cod liver oil and sawdust will enter into active combustion in about 8 or 10 hours, if considerable quantities (*e. g.*, a bushel of sawdust with as much oil as it will take up) be used. If for a moment you reflect upon the oxidation of alcohol in the manufacture of vinegar, as now practised by the agency of twigs, and the heat resulting, you will hardly be surprised at the heat under other circumstances being far greater. A curious case of spontaneous combustion occurred a few weeks since, and which certainly is not marvellous to chemists, but is astounding to those most interested, and which, perhaps, is new to yourself. A mass of iron filings and turnings had been allowed to accumulate at a large factory in this neighbourhood, and day by day were sprinkled with water in the process of laying the dust, previously to sweeping the floor. One night, after all the men had left, a fire broke out, which was soon arrested, but was most clearly traced to the spontaneous combustion of the iron turnings. It is known to every one that iron decomposes water, combining with its oxygen and liberating its hydrogen, and in this case I think that the grease generally attendant upon iron turnings was oxydised at the expense of oxygen condensed by the finely-divided metal, and so lent its aid in raising the temperature; and iron once heated burns with as much activity as tinder or old rags; but long before the heat reached this point the wood in the neighbourhood would have ignited. In your discussions it is much to be regretted that fire insurance companies cannot be left to themselves, while matter of importance to your members is discussed; but this cannot be while men who know very little make long speeches."

PARLIAMENTARY BLUE BOOKS.

In the *Journal* for the 7th of December, 1855, it was stated that Professor Leone Levi had issued the prospectus of a work under the title of "Annals of British Legislation, &c.," which he proposed to publish periodically, in parts, if a sufficient number of subscribers could be obtained. The Institutions will be glad to learn that the First Part of this work has just appeared.* A copy, as a specimen, has been sent to each Institution in Union.

Home Correspondence.

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TEST OF STEEL MANUFACTURES.

Busby, near Glasgow, May 5th, 1856.

Sir,—As no popular practical steel tests are forthcoming in answer to Mr. Wilson's challenge, perhaps the following suggestions, properly carried out, may fulfil the conditions required, not only in reference to the manufacture of steel articles, but to the manufacturing of steel. All workers in steel have sufficiently ready methods of testing its quality for the purposes required, but, as Mr. Wilson observes, "none are popular," and are only known to the initiated.

Aquafortis is well-known for its action on steel, copper, &c. It reduces them very rapidly, and, if the metal be not perfectly homogeneous, will faithfully pourtray its imperfections. Manganese, clay, or other foreign bodies, are plainly observable. I would take those three pieces of metal submitted to you for inspection, and subject them to the following treatment:—I would carefully clean them from all grease, with a little turpentine, as grease resists the action of acid on metals, and then immerse about two inches of their length in the acid, which should be slightly warmed, as it "bites" better when tepid. If the acid be too strong, its biting will be rather slow, in which case a little water can be added. After they have been in the acid about ten minutes, the acid will be found to have penetrated to near the sixteenth of an inch, according as the steel is good, bad, or indifferent. They should be then taken out, and carefully immersed in water, to stop the action of the acid, and then examined as to the quantity of carbon each contains, which should be duly notified—a sufficient quantity will be left on the etched steel for this purpose—the carbon undergoing no change from the action of the acid. I would then rinse and dry them; after this they can be safely examined, the faults of each will be plainly palpable. The best will be evenly etched, and dark in colour, from the exposure of the carbon. The next will be more uneven in surface, with more or less of carbon, according to its manufacture. The next, and worst, will be rougher still, "scabby, rough, or rotten," as the case may be. If one should be found to be iron, it will be deeper etched, whitish coloured, and stringy in the grain. These are a few of the distinguishing peculiarities which the acid brings to light. By this process all the properties of steel or iron are exposed. If the steel be "burned," one or two minutes' immersion will be sufficient to detect it,—its surface will be etched in lines considerably apart, corresponding to the patched surface which the steel exhibits previous to polishing.

Purchasers of either iron or steel in large quantities should invariably use it, as no imposition can be exercised without detection. Critical expedients for detecting the qualities of metal are rather numerous—as weight, for instance. No two pieces of metal of exactly equal bulk, if of different qualities, are of the same weight, &c.

By the acid process, it will be seen that either natural or cemented steel can be advantageously subjected to this test in its manufacture. The process of decarbonisation in the former, and of carbonisation in the latter case, instead of being left, as is now done, to the doubtful skill of the workman, can be subjected to the unerring test of the acid. The manufacturer of steel might get a scale of qualities which have been subjected to this test, marked Nos. 1, 2, &c., with such remarks to each piece as may be a guide to the workman—as to the time in its manufacture, the quantity of carbon found, and foreign matter introduced, &c. Such remarks, with the decided peculiarities of each quality of metal, will be a guide to any intelligent workman.

I am, &c.,
THOS. ALMGILL.

MR. BENNOCH'S PAPER ON FIBRE GILDING, &c.

Sir,—In the *Journal of the Society of Arts*, of May the 2nd, I find a letter from Mr. William Green, containing some excellent suggestions respecting the process of gilding threads or fibres.

Mr. Green complains that I "passed so summarily over the origin of fibre gilding in this country." I confined myself to facts realised, and I am not aware that any gilded thread, excepting those I exhibited as specimens—the produce of Mr. Hock's invention—had ever been perfected so as to become a marketable commodity.

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* Annals of British Legislation. Smith, Elder, and Co., 65, Cornhill.

However, Mr. Green seems to plume himself more on the presumed fact of priority, rather than in superiority of invention. I regret being obliged to affirm that, as regards priority, the claim is against our country, for, long before the process was completed, the principle was established by Mr. Hock, whose first specimens date years before the date named by Mr. Green.

Perhaps you will permit me to remark that the beauty and simplicity of the invention attracted my attention more than any pecuniary advantage that might result from it, believing that any process of gilding that secured to the manufacturer a thread so flexible as to be readily used with any or every other thread, could not fail to become, some day or other, a great commercial advantage.

I would not willingly depreciate the invention of any man, least of all that of Mr. Green. I am, nevertheless, of opinion, after a careful examination of his specification, &c., that he has yet to prove, not only that his plan is superior, but that it is even equal to that of Mr. Hock, whose process I had the honour to describe.

The more I hear of the subject, the more I am convinced that this discussion will lead to a great impetus being given to this branch of manufacture in the United Kingdom.

I am, &c.,
FRANCIS BENNOCH.

TABLE

OF "MONETARY UNITS" AND THEIR DECIMAL DIVISORS, AS USED IN THE ACCOUNTS OF THE VARIOUS COUNTRIES WHICH HAVE A DECIMAL COINAGE, AND THE APPROXIMATE VALUE OF EACH EXPRESSED IN PENCE AND FRACTIONS OF A PENNY.

	d.		*d.*
Naples—Ducat	66		⅔
America—Dollar	50	Cent	½
Sicily—Ducat	42	Bagocchi	½
Holland—Guilder	19	Cent	⅕
Russia—Rouble	10½	Copeck	⅒
France—Franc	9½	Centime	1/10
Switzerland—ditto	9½	"	1/10
Belgium—ditto	9½	"	1/10
Parma—Lira	9½	"	1/10
Savoy—ditto	9½	"	1/10
Sardinia—ditto	9½	"	1/10
Greece—Phœnice	8½	"	1/11
Venice—Lira	8½	Centiesme	1/11
Tuscany—ditto	8½	"	1/11
Portugal—Rees	1/20		
China—Cash	1/35		

S. O. GRAY.

TABLE

OF MONETARY UNITS, THEIR DIVISIONS, AND THEIR NAMES, AS EXPRESSED IN ACCOUNTS, WITH THE APPROXIMATE VALUE OF THE UNITS, AND OF THE SMALLEST COIN OF ACCOUNTS OF EACH, EXPRESSED IN ENGLISH MONEY AND DECIMALS OF A PENNY.

		s.	d.		d.
Great Britain	Pound	20	0	=20 Shillings, 12 Pennies, 4 Farthings	960=.25
Prussia	Thaler	3	0	=30 Groschens, 12 Pfennings	360=.1
Hanover	"	3	0	=24 Gute Groschens, 12 Pfennings	288=.125
Bremen	Rixdollar	3	3	=72 Grotes, 5 Schwaren	360=.10844
India—Bengal	Rupee	2	0	=16 Annas, 12 Pice	192=.125
Bombay	"	2	0	= 4 Quarters, 100 Reas	400=.06
Bavaria	Florin	1	8	=60 Kreutzers, 4 Pfennings	240=.08333
Austria	"	2	0	=60 Kreutzers, 4 Pfennings	240=.1
Hamburg	Mark	1	6	=16 Skillings, 12 Pfennings	192=.09376
Sweden	Rixdaler	1	8	=48 Skillings, 12 Rundstycken	576=.03472
Denmark	Rigsbank Dollar	2	2½	=96 Skillings	96=.27604
Spain	Real de Vellon	0	2½	=34 Maravedis	34=.07858
Turkey	Piastre	0	2¼	=40 Paras	40=.05625
Egypt	"	0	1⅓	=40 Paras	40=.08331
				Aggregate	1d.=.56940

Average .1121, or nearly 1/10 d. -¼

British Museum.

S. O. GRAY.

ON TAKING PHOTOGRAPHIC IMAGES UNDER WATER.

SIR,—Mr. Penney, of Poole, has forwarded to me your communication.

I accordingly enclose you a positive copy, from a negative collodion plate, of a view of a portion of Weymouth Bay, taken at a depth of three fathoms.

The plan I adopted was very simple.

Mr. Kenyon, of this place, and myself, were weather-bound for a few hours at the Portland Ferry Bridge House, and in a room looking on the Fleet water, that was running like a mill-stream through the bridge, within thirty yards of our window.

I was musing, as persons in our then unfortunate condition (namely, weatherbound, and two miles from home and dinner) will muse; and my thoughts wandered to the effect the great force of the Fleet water would have on the piles of the bridge. I passed in review the piles carried away; and the diver's aid called in to examine the amount of submarine damage, and the difficulties and expense which necessarily follow; and the idea occurred to me that the camera might considerably assist us.

I mentioned the idea at once to my friend Mr. Kenyon, and we agreed to test its value at the earliest opportunity. We partially succeeded at our first and only attempt, but non-amateur occupation has, for the present, prevented my further experimenting.

I will now give you an outline of the plan on which I proceeded.

I knew that, could we sink a glass plate, prepared with collodion, to the bottom of the sea, in theory there was no reason why we should not obtain as good an image as we do on land, provided the sea water could be kept from the camera, and that the light was sufficient. I was not sufficiently versed in optics and chemistry to know whether or not the water obstructed any and what light rays.

Following my idea, we made a box as nearly water-tight as we could, and large enough to enclose the camera.

This box is fitted, in front with a piece of plate glass, and on the outside is a wooden shutter, heavily leaded, and which is raised by a string attached to it and communicating with the boat.

On each side of the box is an iron band, terminating in a screw, and projecting beyond the back, which is loose, and fitted with an iron bar, having a hole at each end, through which the screws of the band pass, and thus the back is screwed down tight against the body of the camera by means of a nut; the inner surface of the back is padded, so as to make the camera box, as far as possible, water-tight, when the back is screwed into its place.

The box is fixed to an iron tripod, and a band, with an eye on its upper margin, is passed round both camera, box, and stand; to this eye is attached the rope that lowers the camera to the sea bottom, and by which it is raised. This is the whole of the apparatus employed.

The first thing to be accomplished is to focus the camera, which is done as follows:—The camera is placed in the box on the shore, and a view is focussed, taking as the foreground an object at ten yards distance. This I did with the view now sent, but I fear it is too much. I then fix the stand by means of a triangular wooden frame forced up between the legs of the tripod stand, and which is prevented from slipping down by being attached to the top of the tripod by a line; this keeps the camera frame the exact distance from the ground that it was when focussed on land, and the camera being focussed for the same distance, it stands to reason that, provided the optical and chemical properties are the same, we shall obtain a similarly good picture.

The next thing to be done is to prepare the plate and enclose it.

The plate is prepared with collodion, in the usual way, under a tent. It is then placed in the camera (my camera used for this purpose takes a plate 5 in. by 4 in.). I then take the camera to the box and stand, and throw a black cloth over all. I examine the shutter in front of the camera box to see that it is tight; then, uncapping the camera under the cloth, I place it in the box, and finally draw up the slide. I then push the camera completely into the box, until the front of the lens presses against the plate glass front of the box, and screw on the back tight. The camera is thus, light tight, and properly focussed; and nothing remains to be done but to lower it to the bottom of the sea.

Up to the present point everything has been done on land. We now lash the whole of the apparatus, properly set, to the stern of the boat, and, when we arrive at the proper spot, sink the camera. By means of the lowering rope we can find when the camera is upright at the bottom. When satisfied on this point, we raise the shutter in front of the camera box, by means of the string attached to it, and the other end of which communicates with the boat. The camera is now in action.

The time I allowed for my negative was ten minutes, and you will perceive it is a weak one. It took some time to develope with 3 grains of pyro-gallic acid to the ounce.

There are one or two points worthy of notice as having occurred in the experiment. The first is, that the image is formed on the plate in its natural position, and not inverted. From this it would appear that the piece of glass in front of the camera box, and the water conjointly, act in the same way as a parallel mirror.

Another fact is, that the salt water does not materially injure the plate. With all my care, the great pressure at the depth to which I sunk my camera forced the water into the camera itself, and covered the collodion plate. When I opened the camera and found it full of water, I despaired of having obtained a view; but it would appear that salt water is not so injurious as I had feared. I took the precaution of washing the plate gently with fresh water, and then of dipping it for an instant in the silver bath. The plate was exposed for ten minutes on an ordinary day in the month of February; it took nearly the same time to develope with pyro-gallic acid, using Horne and Thornthwaite's collodion; you will see the negative is a weak one.

I would draw your attention to the line of demarcation between the water and air, which is very visible. The plate was the second one I tried; the first I exposed for five minutes, and obtained no image; and by the time I exposed the one I now send, the light had become very bad. I have not since made a trial, although I have had a better apparatus constructed. The view was taken in a nook of the bay of Weymouth, which is bounded by a ridge of rocks not rising in ordinary tides to nearly the surface of the water. The area within is of sand and boulders, and thickly clothed with sea weeds, such as *Laminaria saccharina*, *Chondrus crispus*, *Rytiphlæa*, and many other species. This will assist you in deciphering the photograph.

This application of photography may prove of incalculable benefit to science. We may take (to a reasonable depth) sketches of submarine rocks, piers of bridges, outlines of sand-banks, in fact, everything that is required under water. Should a pier of a bridge require to be examined, you have but to suit your camera, and you will obtain a sketch of the pier, with any dilapidations; and the engineer will thus obtain far better information than he could from any report made by a diver.

My object in studying photography is in order to illustrate objects of Natural History, as I unfortunately cannot use my pencil. I enclose you a sketch of the lump fish, *Cyclopterus lumpus*, caught on the Chesil beach, and which is not a common fish.

I am, &c.,
WILLIAM THOMPSON.

Weymouth, May 6, 1856.

ENGLISH AND FRENCH SURGICAL INSTRUMENTS.*

Sir,—In Mr. Dunn's speech, at the close of the meeting last Wednesday, he made a statement that is quite astounding. He said, the French have a description of manufacture we have never attempted, viz. surgical instruments; and that, however well they may be made here, nothing is so highly esteemed by English surgeons as a French instrument. Now, if the French instruments are so much desired by the English profession, they can easily please their fancy; for the duty is so trifling, that it is no impediment. But the very reverse is the fact; and were it not for the high protective duty in France, English instruments to a great amount would be sent there. Indeed, English instruments, as well as cutlery, have now, and always have had, a world-wide repute.

I am, &c.,
R. WILLIAMS.

62, Strand, 16th April, 1856.

Proceedings of Institutions.

Belfast.—The Annual Meeting of the Working Classes' Association, for the past year, took place on the 28th of February. From the Report read by the secretary, the following particulars have been selected:—The year's receipts for news-room and library amounted to £250 7s. 8d.; expenditure, £239 16s. 9d., leaving in the Treasurer's hands a balance of £10 10s. 11d. During the year, 271 new Subscribers had availed themselves of the privileges of the Institution, raising the total considerably above that of the year preceding. It appeared, moreover, that books of a more utilitarian character had latterly taken the place of low fiction; and that a demand for History, Biography, and Science, was increasing among the people generally. The Report alluded to two valuable donations of books, presented to the Association by Sir J. E. Tennent, and H. M. Cairns, Esq., M.P.—in consequence of which the shelves of the Library had to be considerably extended. It also referred to the very favourable results of a lecture on "The Northmen," delivered on behalf of the Association's Library, by Right Hon. Lord Dufferin and Cladeboye. It noticed the addition of several of the higher-class periodicals—such as the "Westminster," "Quarterly," "Irish Quarterly," and "Edinburgh" Reviews, to the tables of the Reading-room; and spoke in a confident tone of the Institution being in a fair way of attaining to a self-supporting position. Having gone, with much minuteness, through a variety of details and statistics, the Report concluded with an appeal to the Members, to consider the necessity of their united exertions to provide for the Association a building of more ample accommodation than had been possessed hitherto. It called upon them to consider of what utility to the common weal of such a town as Belfast, might be a building capable of affording means and accommodation for the establishing of public classes, such as had been productive of so much success in several Institutions of a similar character, throughout the empire. The appeal having been responded to with unanimity, and a number of minor resolutions passed, the Meeting separated.

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* It will be observed, from the date of this note, that its publication has been unavoidably delayed.—Sec. S. of A.

LIVERPOOL.—In the month of April four public Lectures on Zoology were delivered at the Collegiate Institution, by Professor Owen. The first lecture was on "Fossil and Extant Fishes;" the second on "Reptiles and their Range in Space and Time;" the third "On Birds;" and the fourth "On the Mammalia, more especially on the Ruminants and their use to Man."

To Correspondents.

◆

ERRATA.—P. 404, col. 2, line 31, after "engraved rollers," take out the semicolon, and insert a semicolon after "purpose," in line 32; and in line 40, take out "but."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 26th and 28th April, 1856.

Par. No.
92. (1) Masters (Navy)—Supplemental Nominal Return.
162. Salted Provisions (Navy)—Returns.
171. Exchequer Bills—Return.
39. Trade and Navigation Accounts (31st March, 1856).
167. Merchant Seaman's Fund—Account.
104. Bills—St. Sepulchre's Manor (Dublin).
106. Bills—Grand Jury Assessments (Ireland).
108. Bills—Commissioners of Supply (Scotland) (as amended in Committee and on Re-committment).
109. Bills—Rating of Mines.
Eastern Papers (Christian Privileges in Turkey)—Part 18.
Kars—Supplementary Papers.
Normal Schools—Reports.
Central America—Correspondence.

Delivered on 29th April, 1856.

41. Local Acts (28. Broadstairs Harbour, Pier, and Landing-place)—Admiralty Report.
120. Trade and Manufactures (Scotland)—Return.
Convict Prisons (Ireland)—2nd Report of the Directors.
Treaty of Peace—Protocols of Conferences held at Paris.
Maritime Law—Declaration.
Re-establishment of Peace—General Treaty.

Delivered on 30th April, 1856.

153. Hops—Account.
172. Metropolis Turnpike Roads—30th Report of the Commissioners.
111. Bills—Procedure and Evidence.
112. Bills—Whichwood Forest (as amended by the Select Committee).

Delivered on 2nd May, 1856.

173. Stamps (Court of Chancery) (Ireland)—Return.
175. Tithes—Return.
176. Barracks (Cavalry and Infantry)—Return.
113. Bill—Coalwhippers (Port of London).
Turnpike Trusts—5th Report by the Secretary of State.

Delivered on 3rd and 5th May, 1856.

180. Valuation (Ireland)—Returns.
182. Home-made Spirits—Account.
184. National Debt—Return.
191. Army Estimates (Original and Reduced Amounts)—Statement.
65. Fisheries Board (Scotland)—Copy of Treasury Minute.
183. Spirits (Ireland)—Returns.
185. Fishery Harbours (Ireland and Scotland)—Return.
187. Incumbered Estates Court (Ireland)—Return of Purchases.
188. Incumbered Estates Court (Ireland)—Return of Number of Petitions.
192. Committee of Selection—6th Report.
103. Bills—Spirit Trade (Ireland).
117. Bills—Juvenile Convict Prison (Ireland) as amended by the Select Committee).
114. Bills—Testamentary and Matrimonial Jurisdiction.
115. Bills—Sleeping Statutes.
118. Bills—Scientific and Literary Societies.
119. Bills—National Gallery (amended).
121. Bills—West India Loans.
United States—Papers relative to Recruiting.
Salt in British India—Report of the Commissioner.
Salt in British India—Appendix to Do.
Salt in British India—Maps and Plans.
Japan—Correspondence.
Education (Schools of Parochial Unions)—Minutes of the Committee of Council.
Trade of Foreign Countries—Abstract of Reports.
Ottoman Empire—Treaty.

MEETINGS FOR THE ENSUING WEEK.

MON. Geographical, 8½, 1. Renewed discussion on "The Centra America Canal:" 2. Captain Stokes, R.N., "Steam Communication with the Australian Colonies and the Cape of Good Hope;" 3. Mr. R. Wallace, "Journey up the Sadong River, in Borneo."
TUES. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Syro-Egyptian, 7½, Mr. Joseph Bonomi, "Reasons for believing that certain Egyptian Pictures and Sculpture contain Representations of a Tribe of the Amakims, mentioned in Scripture."
Civil Engineers, 8, Discussion on Mr. Murray's paper "On the Progressive Construction of Sunderland Dock."
Medical and Chirurgical, 8½.
Zoological, 9.
WED. Literary Fund, 3.
London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphoses of Insects."
Royal Society, Literature, 4½.
Society of Arts, 8, "Professor Clark, "On Means available to the Metropolis and other places for the Supply of Water free from Hardness and from Organic Impurity."
Graphic, 8.
Ethnological, 8½.
THURS. Royal Inst., 3, Prof. Tyndall, "On Light."
FRI. Society of Arts, 8, Extra, Renewed discussion upon Mr. Braidwood's paper on "Fires; the Best Means of Preventing and Arresting them, with a Few Words on Fireroof Structures."
Royal Inst., 8½, Dr. A. W. Hofmann, "On Ammonium."
SAT. Asiatic, 2, Anniversary.
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May 2nd*, 1856.]

Dated 2nd April, 1856.

791. Frances Young, Norwich—Improved two-wheeled open vehicle or carriage.

Dated 9th April, 1856.

858. Richard Chrimes, Rotherham—Improvements in buffers and other springs for railway and other carriages.

Dated 11th April, 1856.

866. Henry Henderson, Glasgow—Improvements in water-closets.
870. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Improved apparatus for measuring the speed of currents of air and water. (A communication.)
872. Robert Davis, 267, Oxford-street—Improvements in the construction of tobacco-pipe stems.

Dated 12th April, 1856.

874. James Nash, Manchester—Improvements in the fusible plugs and furnaces of steam-boilers.
876. Robert Stirling Newall, Gateshead-upon-Tyne—Improvements in telegraphic insulators.
878. Francisco Nuibo y Pedros, 39, Rue de l'Echiquier, Paris—A new motive power.

Dated 14th April, 1856.

880. Edwin Heywood, Sutton, near Keighley—Improvements in fixing apparatus for generating steam, whereby smoke will be prevented or consumed, and fuel economized.
882. Patrick Robertson, Shawlands-hill, Renfrew—Improvements in power-loom weaving.
884. Robert Richardson, Great George-street, Westminster—Improvements in railway switches.
886. Louis Pierre Coulon, 39, Rue de l'Echiquier, Paris—A new type-distributing and composing machine. A communication.)

888. Joseph Barrans, New-cross, Deptford—Improvements in constructing steam-engines.
890. William Warren, Northampton-park, and Warren De la Rue, Bunhill-row—Improvement in the manufacture of envelopes.
892. Leonard Kaberry and Aaron Horsefield, Rochdale—Improvements in moulding for casting certain parts of machinery used in the preparation and spinning of cotton and other fibrous materials.
894. Alfred Vincent Newton, 66, Chancery-lane—Improved mode of constructing grate-bars. (A communication.)

Dated 15*th April*, 1856.

896. William Henry Olley, 2, Brabant-court, Philpot-lane—Taking photographic impressions or pictures of microscopic objects by reflection, such reflection being effected by the combined aid of the microscope and camera obscura and camera lucida or other reflectors that may be employed in place of the latter.
898. Thomas Jeffries, Reading—Improvements in cooking-stoves.
902. William Fuller, Jermyn-street—Improvements in ice pails.

Dated 16*th April*, 1856.

904. Edwin Napoleon Norminton, 12, Charrington-street, St. Pancras—The manufacturing of railway grease for the cleansing and remanufacturing of old used dirty railway grease or greases, for the cleansing and remanufacturing of old dirty cotton waste, tow, or any textile fabric.
906. David Blair White, M.D., Newcastle-upon-Tyne—Improvements in cylinder pistons or plungers.
908. Alfred Vincent Newton, 66, Chancery-lane—Improvements in fire-arms and powder flasks. (A communication.)
910. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in cleansing and hulling grain and seeds, and in the machinery or apparatus employed therein. (A communication.)
912. William Little, Strand—Improvements in lamps for burning paraffine and bituminous oils or napthas.

Dated 17*th April*, 1856.

914. Charles Hulme, Samuel Ivers, and John Yardley, Farnworth—Improvements in power-looms for weaving.
916. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of tyres. (A communication.)
918. Samuel Eyre, Bouverie-street—Improved application of portable mirror.
920. John Skirrow Wright, Birmingham—Improvements in the construction and ornamentation of belt or band fastenings.

Dated 18*th April*, 1856.

922. William Westley, Willington, Derby—Improved nail or spike.
924. John Marsh, Burnt Tree, near Dudley—Improvements in fire-grates.
926. Charles Frederick Stansbury, 67, Gracechurch-street—Improved mode of splicing and fastening the adjacent ends of the rails of a railway track. (A communication.)
928. Uriah Scott, Camden-town—Improvements in metal fittings for furniture.
930. Thomas Walker, Birmingham—Improvements in governors or regulators of steam and other motive-power engines.
932. Julius Jeffreys, Kingston-hill—Improvements in instruments for aiding respiration.
934. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvements in pumps.

Dated 19*th April*, 1856.

938. Edmund Hunt, 31, Walnut-tree walk—Improvements in Hansom cabs and similar vehicles, parts of which improvements are also applicable to other carriages.
940. William Adkins, Smallbrook-street, Birmingham—Measuring fabrics which he proposes designating the automaton measurer or draper's assistant.
942. William Jean Jules Varillat, Rouen—Improvements in the apparatus for the extraction of colouring, tanning, and saccharine matters from vegetable substances.
944. Abram Longbottom, Moorgate-street—Improved means of lighting and ventilating mines.
946. François Jean Bouwens, Malines, Belgium—A new rotative steam-engine.

Dated 21*st April*, 1856.

948. James Nasmyth, Patricroft, near Manchester, and Herbert Minton, Stoke-upon-Trent—Improvements in machinery or apparatus employed in manufacturing tiles, bricks, and other articles from pulverized clay.
950. Jules Dortet, Paris—Improved padlock.
952. Joseph Auguste Marie Touet Chambor, Paris—Improvements in fire-places.
954. James Hansor, 2, Portland-place, Wandsworth-road—Improvements in the manufacture of illuminating gas.

Dated 22*nd April*, 1856.

956. John Thomas Stroud, Suffolk-street, Birmingham—Improvements in stop cocks or taps for regulating or cutting off the passage of gas to combined gas burners.
958. Alexander Symons, George-street, Mansion-house, and Edward Burgess, Clerkenwell-green—Improvements in apparatus for producing alarums to indicate burglary by means of electricity.
960. Alfred Vincent Newton, 66, Chancery-lane—Method of obtaining purified oil from coal, shale, and other bituminous substances. (A communication.)
962. William Smith, Woolston, Fenny Stratford—Improvements in constructing and applying windlasses for working ploughs and other agricultural implements.
964. David Lloyd, Ebbw Vale Iron Works, South Wales—Improvements in washing minerals, coal, and ores.
966. Thomas Evans Blackwell, 1, Cornwallis-grove, Clifton—Improvement in treating water for the use of brewers.
968. Richard Archibald Brooman, 166, Fleet-street—Improvements in or connected with centrifugal machinery. (A communication.)

Dated 23*rd April*, 1856.

970. George Forster, Standish, near Wigan—Improvements in the arrangements of "trap-doors" or "air-doors" and their cases in the workings or passages in mines, whereby the efficient ventilation is maintained, which said improvements are also applicable in other similar situations.
972. James Garnett, Low Moor, Clitheroe—Improvements in twisting, winding, and reeling yarn, and in machinery or apparatus employed therein.
974. Thomas Squire and Charles Frederick Claus, Latchford—Improvements in the manufacture of artificial manure.
976. William Henry Balmain and Thomas Colby, St. Helen's—Improvements in the manufacture of alkalies from their sulphates.
978. Peter Ward, Patent Alkali Works, St. Helen's—Improvement in furnaces used in the manufacture of alkali.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 1*st*, 1856.

2445. William Henry Walenn.

Sealed May 2*nd*, 1856.

2452. Werner Staufen.
2457. James Heginbottom.
2478. Henry Clinton Page.
2488. Joseph Jessop.
2489. Frederic Ludewig Hahn Danchell.
2491. Joseph Schloss.
2496. George Cotsell.
2500. Frederick Scholefield.
2503. William Davis.
2563. William Barnes.
2587. James Yates and Thomas Rawlins Birch.
2600. John Fleetwood.
2647. John Elce and George Hammond.
2648. Samuel Ratcliffe Carrington.
2661. Frederick Osbourn.
2677. John Henry Johnson.
2684. George Richardson.
2855. John Henry Johnson.
2860. John Pierrpont Humaston.
79. John Erskine.
86. William Pole and Frederick William Kitson.
178. William Johnson.
302. Matthew Whiting, jun.
376. Thomas Parkinson Capp.
578. David Yoolow Stewart.

Sealed May 4*th*, 1856.

2499. Joseph Haley.
2523. Henry Fletcher.
2534. Henry Wickens.
2536. Jules César Alexandre Bouillotte.
2537. Louis Joseph Frédéric Margueritte.
2540. George Cocke.
2541. Thomas Hitt.
2557. Robert Murdoch.
2645. John Jobson.
155. Charles Robertson.
160. Edward Lawson and George Jennings.
215. William Spurrier.
367. Thomas Evans Blackwell.
420. William Gwillim Merrett.
453. Frederick William Mowbray.
469. James Warburton.
473. Charles Brook, jun., and Joseph Hirst.
503. Edward Ellis Allen.
533. Alfred Francis.
535. Cyprien Marie Tessié du Motay and Jean Jacques Fontaine.
553. George Lodge, sen., John Ogden, and George Lodge, jun.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

April 28*th*.

1078. Richard Quin.
1094. John Scott Russell.
1121. Christopher Nickels.

April 30*th*.

1080. Frederick Arnold.
1151. John Henry Johnson.

May 1*st*.

1057. Henry Constantine Jennings.
1061. George Murton and William Hatton Langshaw.
1097. William Edward Newton.
1125. James Nichol.
1285. William Edward Newton.
903. William Henham.
1836. George Goodlet.

May 2*nd*.

1095. Charles Goodyear.
1109. Thomas Symes Prideaux.

May 3*rd*.

1116. John Ryan Danks and Bernard Peard Walker.
1156. Marie Pierre Ferdinand Mazier.
1186. Richard Archibald Brooman.
1223. Bernard Peard Walker and James Warren.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3833	May 6.	Street Gully, or Stench and Sediment Trap	John Michael Butt and Co.	Kingsholm Iron Works, Gloucester.
3834	May 7.	Improved Invert Block for Sewer or Conduit Bottoms	Joseph Cliff	Wortley, near Leeds.

Journal of the Society of Arts.

FRIDAY, MAY 16, 1856.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 14, 1856.

The Twenty-second Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 14th inst., John Simon Esq., F.R.S., Medical Officer to the General Board of Health, in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Christian, Robert.
Maxwell, Sir William, Bart.
Rough, Robert.
Thomson, Adam.
Woodhouse, John Thomas.

The paper read was—

ON MEANS AVAILABLE TO THE METROPOLIS AND OTHER PLACES, FOR THE SUPPLY OF WATER FREE FROM HARDNESS, AND FROM ORGANIC IMPURITY.

By Professor Clark, M.D., of Marischal College and University, Aberdeen.

Pure water, that is, water apart from all other matter, is hardly to be found in nature. Rain water is only one approximate to pure water; distilled water is but another; melted bright ice is perhaps a nearer approximate; but were we to repeat the operations of distillation, or of freezing water and then melting the ice, we would obtain water that for all practical purposes is pure.

Now, let us attend for a little to what will take place when solid matter is brought into contact with pure water; first, in a case where the solid is insoluble—say, a stone. The water and the stone produce no effect on each other, further than that the stone, being bulk for bulk heavier than the water, will sink to the bottom. If, again, we break up the stone and bruise it into powder, still the powder will sink to the bottom, but now more slowly, in proportion as the powder has been ground fine, the rougher grains of the powder falling first; but very fine powder may be hours, and even days, of subsiding, so as to leave the water clear. The temporary suspension of the fine powder in the water, and the final subsidence of it, are alike *mechanical* operations. The powder was for a time suspended in the water, much as dust may for a time be suspended in the air, and on repose fall down again; the coarser particles first, the finer last, but finally all down, quite unaltered in its properties.

Now, as it is by *mechanical* means that the insoluble solid is kept for a time suspended in the liquid, so it is by mechanical means that they are separable. Subsidence is only one of those means; filtration is another. The solid is arrested on the surface, or not far below the surface of the filter, by means as mechanical as a sieve.

Without engaging at present in any discussion about the process of filtration, this much I may state by way of indicating one limit that restricts the usefulness of this process, that many rocks, when ground into very fine powder, and much soaked in water, acquire an adhesive consistence—that is, become of the nature of clay. Solid matter of such consistence readily diffuses in water, and, for all practical purposes, is incapable of being satisfactorily separated, either by subsidence or by filtration. Accordingly, it often happens that river water is very imperfectly cleared by filtration, after such rains as wash into it the finer particles from the surface of roads and fields.

But, next, if the solid brought into contact with pure water be soluble, instead of insoluble, a very different result will be obtained. Let us, for instance, drop into one glass of water a little salt, and into another a little sugar, and stir about; the salt and the sugar will disappear; the taste will denote a different change in each glass of water. What was before, in each glass, a solid and a liquid, will now be all a liquid. We call the results, not mixtures, but solutions. The change is not mechanical, it is chemical. No longer will the solid sink to the bottom on repose; no longer will the solid be separable from the liquid by filtration. On the contrary, the solution may itself be mixed with solid matter, and be separated from it by means of subsidence or filtration, and be then found precisely the same solution it was before.

You can easily understand now that spring water, which seldom contains any solid matter in a state of mixture, is generally a specimen of water with solid matter in it in a state of solution; for spring water always has in solution more or less of solid matter; very commonly between 1 to 1,000 and 1 to 20,000 of water; sometimes even 2 or more to 1,000. But while spring water is an instance of water with solid matter in it in solution, river water often affords instances of water with solid matter in it, both in a state of solution and in a state of mixture.

Thus far we have been considering water as it acts on solids, mechanically or chemically; as a lifeless liquid acts on a lifeless solid. I am going now to do little more than mention a case where vegetable and animal life come into play. It is not so in all waters, but in a great majority of those in and around London this happens: that free as the waters may be from any mixed solid matter—and they generally are so when pumped up from wells fed by springs—vegetation on the surface of the water, and on the sides and bottom of reservoirs, will appear spontaneously, as it were, after a certain exposure of the water to light and air. This vegetation soon comes to be accompanied with animalcules and various organic objects in great numbers; and in process of time the vegetation and the animalcules, which have their period of growth, come to have also their period of decay, and to be a great source of contamination to those waters.

Returning again for a little to solid matter in solution, let us advert to the nature of such solid matter, in the view of explaining the cause of that quality of water called hardness.

The great bulk then of the solid matter held in solution in ordinary waters, consists of salts; that is, combinations of acids with various bases. The acids are chiefly:—Carbonic acid, producing carbonates; sulphuric acid, producing sulphates; nitric acid, producing nitrates; and hydro-chloric acid, producing chlorides.

The saline bases are chiefly:—Soda; potash, less frequently; ammonia, in small quantities and rarely; lime; magnesia.

For the present, it is neither those acids apart from the bases, nor these bases apart from the acids, that we have to do with; but the acids and bases combined in the form of salts, whereby the peculiar characters of their components are neutralised.

Now, in this neutral state, we need give ourselves little trouble as regards the acids; for I found on trial that the hardness of a water is quite unaffected by any one of the before-named acids being substituted for another. Then as to the before-named bases, the only ones that affected the hardness of water, I found to be lime and magnesia. These two bases are the sole hardeners of ordinary waters; lime the chief. When magnesia occurs along with lime, as is very common, this base is the great *curdler* of soap. A lime salt by itself in water, a magnesia salt by itself in water—either of these is a destroyer of soap; but magnesia along with lime is often a great curdler of soap, without otherwise being a destroyer of it.

This explanation of the cause of hardness will prepare you for entering on the subject that it is my duty to explain to you to-night. In most waters around the metropolis, whether found in rivers or in wells, it is chalk that is the chief cause of their hardness. Now, this chalk may be removed from the water by a very simple and inexpensive process that I proposed fifteen years ago, that has been in successful operation on a large scale in waterworks near Woolwich, for a year and a half past, and that may at any time be brought into operation on a scale more than adequate for the supply of this great metropolis. In such abundance is this hardening matter present, that the process alluded to can separate a ton of chalk from every million of gallons of the purest accessible spring waters. The average supply of a single family would yield up 100 lbs. of chalk in eight months, or a pound and a quarter every three days. So great is the effect of the invention in softening, that whereas the hardening matter of 100 gallons of spring water from wells or borings sunk in the chalk strata will destroy 35 oz. of soap, the hardening matter remaining in 100 gallons of the same water, after being softened, will destroy only 5 oz. The process removes from such water 85 per cent. of the hardening matter.

In order to explain how the invention operates, it will be necessary to glance at the chemical composition and some of the chemical properties of chalk; for while chalk makes up the great bulk of the matter to be separated, chalk also contains the ingredient that brings about the separation. The invention is a chemical one for expelling chalk by chalk.

Chalk then consists, for every 1lb. of 16oz., of

Lime	9oz.
Carbonic acid...........	7oz.

The 9oz. of lime may be obtained apart, by burning the chalk, as in a lime kiln. The 9oz. of burnt lime may be dissolved in any quantity of water, not less than 40 gallons. The solution would be called lime water. During the burning of the chalk to convert it into lime, the 7oz. of carbonic acid are driven off. This acid when uncombined, is naturally volatile and mild; it is the same substance that forms what has been called soda water, when dissolved in water under pressure.

Now so very sparingly soluble in water is chalk by itself, that, probably, upwards of 5,000 gallons would be necessary to dissolve 1lb. of 16oz.; but by combining 1lb. of chalk in water with 7oz. additional of carbonic acid, (that is to say, as much more carbonic acid as the chalk itself contains,) the chalk becomes readily soluble in water, and when so dissolved, is called bicarbonate of lime. If the quantity of water containing the 1lb. of chalk with 7oz. additional of carbonic acid were 400 gallons, the solution would be a water of the same hardness as well water from the chalk strata, and not sensibly different in other respects.

Thus it appears that 1lb. of chalk, scarcely soluble at all in water, may be rendered soluble in it by either of two distinct chemical changes—soluble by being deprived entirely of its carbonic acid, when it was capable of changing water into lime water, and soluble by combining with a second dose of carbonic acid, making up bicarbonate of lime.

Now if a solution of the 9oz. of burnt lime, forming lime water, and another solution of the 1lb. of chalk and the 7oz. of carbonic acid, forming bicarbonate of lime, be mixed together, they will so act upon each other as to restore the 2lb. of chalk, which will, after the mixture, subside, leaving a bright water above. This water will be free from bicarbonate of lime, free from burnt lime, and free from chalk, except a very little which we keep out of account at present for the sake of simplicity in this explanation. The following table will show what occurs when this mutual action takes place:—

AGENTS.			PRODUCTS.	
Bicarbonate of lime in 400 gallons ...	Chalk .... with	16oz.	= 16oz. of chalk.	= 2lb.
	Carbonic acid	7oz.	= 16oz. of chalk.	
Burnt lime in 40 gallons of lime water		9oz.		

But, instead of the whole chalk being separable by the process from the water, only 10-11ths would be separated; so that, with regard to chalk, the accurate result would be expressed, if we suppose 440 gallons of similar water to be operated upon, containing 17½oz. of chalk. There would be separated, 16oz.;—there would remain in solution, 1½oz. Or, to express the result with reference to a single gallon, each gallon would contain of chalk, if unsoftened, 17½ grains; if softened, 1½ grains; and would deposit 16 grains.

Here is a convenient place to explain a mode of expressing hardness, in very general use now, but first invented by me, in connection with certain new chemical tests of water, in order to work out conveniently the softening process that has been described.

Each degrees of hardness is as much hardness as a grain of chalk, or the lime, or the calcium, in a grain of chalk, would produce in a gallon of water, by whatever means it may be dissolved.

Thus, our supposed water would be 17½ degrees of hardness before softening; 1½ degrees after softening. And this would be the real result, supposing there were in the water no other hardening matter but chalk; but in the best quality of chalk water from springs or wells in the chalk strata around the metropolis, there is actually present a small proportion of other hardening matter, such as to prevent the water from being softened lower than 2½ degrees. A gallon of such water, after being evaporated, was found to have held in solution of solid matter—

	Grains.
Before softening	23
After	7
The difference	16

was due to chalk removed by the softening process.

These explanations will make it easy to comprehend the sucessive parts of the softening process.

Supposing it was a moderate quantity of well water from the chalk strata around the metropolis that we had to soften, say 400 gallons. This quantity, as has already been explained, would contain 1lb. of chalk, and would fill a vessel 4 feet square by 4 feet deep.

We would take 9oz. of burnt lime, made from soft upper chalk; we first slack it into a hydrate, by adding a little water. When this is done we would put the slacked lime into the vessel where we intend to soften; then gradually add some of the water in order to form lime water. For this purpose, at least 40 gallons are necessary, but we may add water gradually till we have added thrice as much as this; afterwards, we may add the water more freely, taking care to mix intimately the water and the lime water, or lime. Or we might previously form saturated lime water, which is very easy to form, and then make use of this lime water, instead of lime, putting in the lime water first, and adding the water to be softened. The proportion in this case would be one bulk of lime water to ten bulks of the hard water.

I call your attention to one circumstance in the arrangement just described—that the lime, or softening ingredient, is put into the vessel *first*. Hence there will be an excess of lime, always causing to be present in the mixture, so long as the process is going on, more of lime than is necessary for effecting the precipitation of the chalk present in the water. The expediency of thus keeping up an excess of lime till we come to the end of the process arises from this important practical fact, that the chalk (or carbonate of lime) produced in the process is far more easy to precipitate where there is lime water in excess. Another remarkable fact is, that the carbonate of lime thus precipitated forms, not into a powder, but into crystals, distinct enough to be seen in sunshine. But what you will wish to know now is, by what mark is the conductor of the process to find out when there is enough of water to take up the last of the excess of lime, so as to be enough but no more.

This is done by what has been called the silver test; the only test necessary to the operator after the process is fairly set agoing. This test is a solution of nitrate of silver in twice-distilled water, in the proportion of an ounce per pint. In making use of the silver test with ordinary waters, we get a white precipitate; but if the water have in it a notable excess of lime water, there is a light reddish brown precipitate produced; but if the excess be very slight, we get only a feeble *yellow* precipitate. The way we make use of the test is to let two or three drops of it fall on the bottom of a white tea-cup; then add the water somewhat slowly; then if there be the slightest excess of lime, a yellow colour will show itself, though it will sometimes disappear again on adding more water. In practice, we may even leave the mixture when it affords a barely perceptible trace of this yellowness; for on the waters being exposed to the air for a night, a very slight remaining excess of lime will probably no longer be indicated when the test is applied next morning. The carbonic acid of the atmosphere suffices to destroy a very slight excess of lime.

Other tests than the silver test were invented by me in order to make it easy, in an approximate way, to ascertain how much lime should be provided for softening a given quantity of any water submitted to those tests. It would be out of place here to enter on an explanation of them; but when the lime has been adjusted to the water in suitable proportions by means of those other tests, it is by the silver test that we make the final adjustment; and *with such accuracy may this adjustment be made, that a given water may be softened on several successive occasions, and on any scale between a pint and millions of gallons, without the softened water ever exceeding its minimum possible hardness more than* 1-10*th of one degree of hardness.* Repose will finish the process. Over the subsided chalk there will be a clear soft water, fit for immediate use.

The softened water thus obtained has no action on lead pipes or cisterns, as many soft waters have.

While the results here given represent accurately the change in hardness produced by the invention on the most abundant and best well water from the chalk strata around London, there are, in particular localities, wells with inferior water, which, although greatly benefited by the application of the process, cannot be made so soft as has been described. Thus, in Plumstead Water Works, for supplying Plumstead, Woolwich, and Charlton, with well water softened by the invention, the hardness of the water I found to be about 21½ degrees when pumped up, and about 8½ when softened, but still it is true of this softened water, that all the hardness in it remaining from chalk does not exceed 1½ degrees, the same as in the choicest chalk spring water. The other 7 degrees of hardness are due to other hardening matter than chalk.

The softening process may be advantageously applied in many places to spring water derived from the new red sand-stone formation.

In the natural course of discussion, I should now enter on an explanation of the works at Plumstead, in the neighbourhood of Woolwich, where the softening process has been in successful operation for the last year-and-a half. Addressing you in the presence of the engineer who has planned those works with much skill and success, I feel how much more advantageous it will be to you, and how much more agreeable it is to myself, to refer you for this explanation to Mr. Homersham. The process is of a nature to require a larger scale of operation than any other heretofore practised within the circle of chemical manufactures. With such a process to put into operation for the first time, there was no small difficulty in making a fitting choice of devices, and means to insure the successful and undisturbed application of the process, and so very successful was the application in this instance, that the works have continued in operation till now without any material alteration, and continue to be a fitting model for works on a much larger scale.

Experience at the Plumstead water works has proved that in the working of the softening process a settling reservoir may be filled up with water and its mixture of precipitated chalk, may be left to subside, and may be pumped out for use daily, and that the softening process may go on for months without its being necessary to remove the precipitated chalk. A ton of pure burnt lime will produce 3½ tons of this precipitate, which forms a very superior kind of commercial whiting. Unfortunately I am not in a position to state from experience what is the commercial value of it as whiting, because the water company, for reasons unknown to me, have heretofore declined, or delayed to provide means for collecting the precipitated carbonate unmixed with gritty matter; but according to the best information I have been able to obtain, the burnt lime and the whiting produced are weight for weight nearly of the same commercial value; that is to say, about £1 per ton, so that £1's worth of burnt lime will produce £3 10s. worth of whiting. According to this estimate, it is probable that the process will, when worked with due care, come nearly to pay its own expenses, including the interest of capital expended in such erections as the softening process makes necessary.

Farther than removing chalk, the process has not been observed to operate with any marked effect, so far as the *mineral* matter in solution is concerned. The removal of the chalk is attended with several advantages.

1st. The water is much softened, and there is a considerable saving in soap, as has already been stated. There is besides, in washing, a still more considerable saving in the wear and tear of clothes. Soda, which is sometimes added to hard waters for the purpose of softening them, produces a yellowness, more especially in flannels, and is injurious to certain dyes.

2nd. Soft water is much more pleasant to wash in and to bathe in, and the hands are less apt to be chapped. Soft water also is notoriously better for making tea, and cooks more readily such articles as rice or peas.

3rd. Owing to the previous removal of chalk, there is no powder or incrustation from the softened water on boiling, as is the case with unsoftened chalk water. Dirty clothes are apt to have dirt fastened in them by this deposit, when the clothes are steeped in warm water. It is probably the absence of this deposit from softened water that leads the laundresses to say that they can produce their linens much purer by the softened water than by the unsoftened.

Among chemical processes the one that we employ for softening chalk waters is remarkable for this, that it merely removes certain matter from waters without substituting any other matters in its place. Most chemical processes, when they produce a precipitate from water, leave in solution matter of another kind in its place. Accordingly, 7,000 gallons of chalk spring water, which contain 23lbs. of solid matter in solution, whereof 16lbs. fall down in the form of chalk, retain in solution only the remaining 7lbs.

So far, then, as regards the mineral matter, the change effected by the softening process consists in the removal of most of the chalk that the water contains. Let us now proceed to consider what effects the softening process produces, as respects organic matter.

Since in general the wholesomeness of a water is much more affected by the presence of organic matter than by the presence of mineral matter, freedom from organic matter is of still more importance than freedom from hardening matter. It seems a fact well established by observation, that some of the poisons producing epidemic disease find a congenial *habitat* in waters contaminated with organic matter.

Now, chalk water may be contaminated by organic matter, either first, from without, or second, from within.

1st. *From without*; as in a river, by surface drainage, or land drainage, or even by the sewage of houses and towns.

In the case of a water thus contaminated, a considerable proportion of the contaminated matter is incorporated with the precipitated chalk, and is removed with it. This fact appears on double evidence. On the one hand, the chalk precipitated from contaminated water is much more coloured than chalk precipitated from a pure solution of bicarbonate of lime, and when scorched in a clean glass tube gives off an offensive smell not recognisable when the chalk is pure; on the other hand, the softened water is much freer from colour than the unsoftened.

2nd. *From within.* When chalk spring water is pumped up from a well and exposed to light and air in a clean glass vessel, capable of holding a few gallons, with a glass covering, and so exposed that we can observe the changes as they take place from day to day, it will be seen that all around the sides and bottom a green vegetation will appear in summer time within a few days. In process of time this vegetation tends to a brown, and if a close observation be made, a slight incrustation may be discovered, partly to float on the surface of the water, and partly to adhere to the sides and bottom of the vessel. This incrustation consists of chalk slowly precipitated from the water by the decomposition of the duplicate dose of carbonic acid that kept the chalk dissolved. The decomposed carbonic acid affords carbon (charcoal) to the plants, and the chalk that was kept in solution by it forms the mineral part of the incrustation. If the glass vessel, after having been exposed as described for several weeks, be emptied, a dirty-like brownish incrustation may be very well seen, including vegetable matter, all down the sides and on the bottom. This brownish incrustation has a strong, offensive, marshy smell. If side by side with the spring water there be exposed, in a similar glass vessel, the same water, only previously softened, the softened water will continue for weeks and months unaltered, all the while that the unsoftened water is becoming more and more contaminated from within.

The vegetation that is here represented truly as having been observed in a glass vessel in a few days, begins in practice, on the large scale, as soon as chalk spring waters enter into light. On looking down a wide cast-iron pipe of many feet in depth, employed as a channel for a copious spring to rise perpendicularly to the surface of the ground, there may be seen on the inside of the pipe, so far as light will permit the observer to see down, a brown hair-like vegetation of the offensive character already described. Where a chalk spring feeds a stream in an earthy channel, specimens of this offensively smelling vegetation may be found within a few yards of the spring.

Eight months after the Plumstead Water Company had been carrying on the softening process with success, and much to the satisfaction of the consumers, it occurred to the Company to try how far the consumers would continue to be satisfied with the water, if the softening process were omitted. The experiment was, of course, made without any advice of mine, and even without my knowledge, but I feel very much obliged to the Company for having made it. The account that I obtained of the result was received by me from a friend who visited the works on the eleventh and twelfth days after the addition of lime to the water had been omitted. My friend, who had visited the works repeatedly, but had never witnessed a trace of vegetation on the surface of the waters in the softened state, and who had not heard of the change, had more than one sense taken by surprise. On entering within the boundary, but roofless, walls that surround the reservoirs (it was on the afternoon of a calm, hot July day), he was saluted with a stench of decaying vegetable matter, and beheld the surface of the unsoftened water (which was now daily supplied to the reservoirs, and daily removed for use) all covered with masses of vegetable matter (*confervæ*), to such an extent as, he wrote me at the time, scarce could a square inch of the surface be observed uncovered. No microscopic observations of the water were made at the time. If they had been made, I have no doubt that animalcules would then have been found as abundantly as they may now be found in the water of any company that now supplies the metropolis; though, of course, without any of those peculiar organic objects that are introduced by means of drainage and sewage. Not slow were the consumers in discovering the sudden hardness that had come over the water, nor were they silent under the discovery, and the company gave up their instructive experiment at the end of three weeks.

As to the sources available for the supply of water to the metropolis, they have more especially of late years been so much discussed, that they may be specified and dismissed in a few words.

In regard to the water of the Thames, so far as it is under the influence of tides, we have come, however tardily, to the conclusion that water such as has, however well or however ill, performed its duty in the sewers of the metropolis, is not again fit or even seemly for the use of the inhabitants of the metropolis. So far as the matter of sewage continues to be admitted to be a proper element of water fit for domestic use, it is no longer the sewage of the metropolis, but the sewage of the many towns draining into the Thames above Teddington Lock, that is recognised by the indifference of the public and the wisdom of Parliament, as of this harmless quality. It is an old maxim, and a true one, that there is no disputing about tastes. Upon some subjects, he that increaseth knowledge increaseth sorrow; so I refrain from adding any observations to disturb the satisfaction of such as deem the contents of sewers to be rather a good thing in water, whether the sewers be in town or country. But passing from this, who shall prevent the contamination that rivers are subject to, from time to time, by the fall of heavy rains? Experience has taught us that filtering will not arrest or prevent the presence of numerous animalcules, many of them visible to the naked eye, in the filtered water of the Thames, whether supplied from above or below Teddington Lock. Indeed, such is the sluggish motion and stagnant state of the Thames above Teddington Lock, that I doubt whether the water supplied from thence will not be more loaded with organic matter than it would be if the supply were taken within a mile or two below that Lock. It is no uncommon thing for the microscope to discover minute insects in the filtered Thames water; not twenty per each half-gallon, but twenty different species. Then, apart from the organic contamination that mere filtration will never separate from the Thames water, and which would never be found at all in the softened water that I have been describing, there is the disadvantage of hardness, which is five times greater in the Thames than it would be in the softened water.

And what shall we say, in the middle of the nineteenth century, of the treatment that spring water receives, in order to prepare it for the domestic use of the metropolis? Two hundred and fifty years ago, Sir Hugh Myddleton bethought him of making a canal to lead spring water as direct as he could into London, and his canal is known to this day as the New River. I have already explained to you that chalk spring water (which this was) acquires contamination by simple exposure to light and air. Sir Hugh Myddleton, or the known resources of his time, could not avail to hinder this. But with all our known resources, it seems that a wealthy company, like the New River, can do no better for us yet than dilute their five million gallons of daily supply of spring water with somewhere about double its own bulk of contaminated water from the river Lea, leading the mixture to London by a channel that has been made indeed recently somewhat straighter than Sir Hugh's; and when the spring water has kept company long enough with the dirty Lea, the New River

Company pretends to get rid by filtrationof the contamination thus inevitably acquired by spring water.

As to the deep wells in and around London, it were needless to say much, for it is notorious that the supply from that source is already overtaken by the numerous wells that have been sunk for the supply of breweries and other manufactories.

As to the project that came out, some years ago, from the General Board of Health, in the first years of its existence, I could perhaps speak somewhat advisedly, for I have gone over a good part of the ground, have collected specimens of the various waters, and have examined them chemically, and I am aware of microscopic examinations that have been made of the same specimens, by competent friends of mine, but the project is a dead project, and according to the maxim, that we should speak nothing but what is good of the dead, humanity dictates that we should say nothing at all of this project.

As to the sufficiency of the chalk strata for the supply of the metropolis with water, from places where the chalk is not loaded with superincumbent clay, I do not enter into any discussion. The subject was ably laid before this Society by Mr. Homersham, on the 31st January, 1855, in his paper "On the Chalk Strata, considered as a Source for the Supply of Water to the Metropolis." I refer to his paper for satisfactory information on this point.

Under date 21st of December, 1854, Dr. Hassall concludes a microscopic report to the General Board of Health, by whom he had been employed, in the following words, with which, too, I ask your leave to conclude this paper:—

"From all that has been now advanced in reference to the condition of the water supplied by the different metropolitan water companies, it appears that, during the period of this inquiry, when the cholera epidemic prevailed, as well as subsequently, the waters furnished by these companies were very far from possessing the requisite purity, in consequence of the large quantity of organic matter (which is the worst contamination to which water can be subjected) contained in them. Even in the water supplied by the Lambeth Company, which is comparatively the purest of the whole, organic productions, dead and living, animal and vegetable, are found in not inconsiderable numbers, and this water furnishes the type of that with which, in 1855, the greater part of London and its vicinity will be supplied, in accordance with the recent Act by which the water supply of the metropolis was regulated.

"The metropolis, then, after that year, will still continue to be supplied with river waters containing various kinds of organic matters, including numerous living productions. Now, that there is no necessity that this should be, has been clearly proved by the case of the Plumstead Water Company, which supplies a water entirely free from living organic productions of every description." *

DISCUSSION.

Mr. Thomas Wicksteed (of Leicester) said, in a note to the Secretary:—"I have, myself, no doubt that the effect produced by the process recommended by Dr. Clark is to soften certain hard waters. My late friend, Mr. Arthur Aikin, told me, about ten years ago, that he had been in the constant habit, for above forty years, of using lime to soften and clear New River water, whenever he required any for particular purposes in his laboratory; and my friend, Mr. Thomas Jennings, of Cork, told me, about the same period, that he had used lime for the same purpose nearly thirty years previously, upon a somewhat large scale, in certain operations carried on in his business as a manufacturing chemist."

The Chairman said, the meeting would no doubt be anxious to hear opinions on the subject of Dr. Clark's very interesting communication. The promise it held out of providing water free from hardness and organic impurities, was one of such great importance to health and comfort, that if it could be realised, the metropolis and the world might well be grateful to the author of the paper. He saw present some very distinguished chemists, who would probably assist in the discussion by giving their opinions; but as the author of the paper had made special reference to the engineer by whom the Woolwich Water Works—which might be called the model works, in relation to this subject—were constructed, and as Mr. Homersham was present, he hoped that gentleman would first favour them with some observations on the subject.

Mr. Homersham said, that about the close of the year 1852, he was called upon to design and construct the works necessary to supply the parishes of Plumstead, Woolwich, and Charlton, with water to be derived from the chalk strata. A plentiful supply of very good water was soon obtained from a small boring, and a well with adits or small tunnels communicating with it, driven in the chalk at a proper depth below the surface of the ground. The water was characterised by being always (summer and winter) at the same temperature, about 52° Fahr. It was fresh, clear, and bright, and well aërated, and when pumped up from the well was quite free from any putrescible organic matter. The water, however, as it came from the well, was from 20 to 21 degrees of hardness, and contained, in solution, both bicarbonate and sulphate of lime. As nearly the whole of the bicarbonate of lime, or chalk, could be taken out of the water by means of the process described in Dr. Clark's paper, he strongly advised the Directors to make use of the process, which they agreed to do, and after communicating with Dr. Clark, he (Mr. Homersham) designed and made the works requisite to soften about 600,000 gallons of water per day. These works had been completed and in use for the last eighteen to twenty months. The Company already supplied about 8,000 houses with the water softened to about 8 degrees of hardness. These 8 degrees were nearly all due to sulphate of lime. The number of houses supplied was rapidly increasing. The manner of carrying out the softening process at the works was as follows:—The lime used was flare lime, made from the upper chalk. Such lime, fresh burnt, was gradually slacked in small quantities in a tub with water, and was passed through a fine sieve, of about 10 meshes to the inch, into a cast-iron cistern. The cistern, which held about a day's supply when full, remained undisturbed for twelve hours, when a quantity of clear water, found to stand above the lime paste, was drawn off, and the lime paste or cream of lime, as it was called, was stirred up to make it all of a uniform consistency, when it was ready for use. A quart of such cream of lime contained in weight about 1lb., or rather more, of dry unslacked lime. As the water (about 900 gallons a minute) was pumped up from the well, a suitable quantity of this cream of lime was passed, by means of a large cylinder and piston moved by the steam-engine, into the pipe through which the water was conducted from the well. The cream of lime and water were intimately mixed by causing them to pass together through two, what were called, agitators, placed at a little distance apart. Between the two agitators, a well, six feet internal diameter, and open at the top, was interposed, so that all the lime and water, after it had passed through the first agitator, went into this well on one side, and passed out of it again on the other side, to the second agitator, on its way to the depositing reservoirs. The object of this well, which was five feet deep below the entering pipe, was to allow any gritty matter that by accident might be introduced with the lime into the water to fall to the bottom, and so prevent its passing into the depositing reservoirs. The agitator merely consisted of an enlarged pipe, 21in. internal diameter, and about 6ft. in length, containing within and around it 3 plates of wrought iron, about 2ft. apart, having

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* Appendix to Report of the Committee for Scientific Inquiries in relation to the Cholera Epidemic of 1854, p. 271.

in them about 110 holes, each one inch in diameter. As the lime and water passed together through the holes at a speed of about 50 inches a second, they impinged quickly against the water in the body of the pipe, which moved only at the rate of 12 inches a second. The lime and water in this way became intimately mixed, and passed on together into a reservoir prepared to receive them, capable of containing (after leaving room for the chalk deposit at the bottom) 600,000 gallons, or one day's supply. The reservoir was divided into three compartments, each capable of holding 200,000 gallons, for convenience in emptying and filling. When the reservoir was being filled, the lime, at the commencement of filling, was added in excess to the water, so much so, that when the reservoir was only three-fourths full, the remaining fourth part was filled up with pure water from the well. In practice, the adjustment of the exact proportions of lime and water was very easy; the silver test was used for the final adjustment of each compartment of the reservoir, as described in Dr. Clark's paper. The reservoir being thus filled with lime and water, and adjusted by the silver test, in about 16 hours afterwards all the chalk or carbonate of lime had fallen to the bottom, the water had become perfectly clear, and it was then pumped up to the service reservoir for the supply of the consumers. When the reservoir was emptied of the softened water down to within about two feet of the bottom (so as not to disturb the deposit), it was again filled with lime and water as before, the deposit not being taken out until it was 17 or 18 inches deep; this did not occur more than once in eight or ten weeks. The pipe through which the water passed from the well, after the cream of lime was mixed with it, to the depositing reservoirs, was a closed cast-iron pipe, 14 inches in diameter, and about 75 yards in length. It was found for this length, at Plumstead, that the pipe got very slowly coated with a deposit of furr or crystallised carbonate of lime. The same kind of furring or deposit of chalk also took place in the agitators, but by making proper provision for clearing out the deposit which adhered to those parts, they could very easily be kept clear. He only mentioned the circumstance in order that any one adopting the process might make the provision for cleaning out the furr that he had alluded to in the first instance. Altogether the process was a very simple one in practice, and required no more attention than filtering did. In every respect the Company, by adopting the process, had realised all that Dr. Clark had led them to expect, or that he (Mr. Homersham) had expected. Upon the table was a sample of the deposited chalk, which was in as fine a powder as the finest whiting of commerce, and which had been brought that morning from the works at Plumstead.

Mr. **Frederick Braithwaite** said he had been invited to attend that evening and take part in the discussion upon the best and most efficient means of supplying the metropolis and other places with the best water from the best sources. He did not mean to complain that the discussion, so far as it had already gone, had not at all touched upon that subject, but it seemed to him simply to amount to an explanation of Dr. Clark's ingenious and excellent patent for depriving water of its chalky particles. He would take the liberty of differing from Dr. Clark as to whether it was so desirable to deprive the water of its chalk, for if he had read the works of Liebig and other chemists aright, it appeared to him that in some form or other—either in the drink or in the food—a certain amount of chalk was indispensible for maintaining the functions of animal life. There was an instance of an experiment tried by Liebig, of some pigeons breeding; the parent birds were supplied with drink and food from which all particles of chalk and lime had been extracted; the consequence was, the young birds hatched grew in the nest, but, as they never had any bones they were not able to quit the nest. The same kind of experiment was practised upon a breeding cow, and the consequence was, the calf was born, but it could not stand up because it had no bone. They had heard a great deal about the filthy condition of the water of the River Thames, and the large amount of salts and organic matter which it was said made that water so destructive to the health of the inhabitants of London. He could assure them it was a great mistake. He could tell them that a gallon of water taken from the Thames at Teddington-lock, and weighing 70,000 grains, was found to contain only from 20 to 29 grains of solid matter per gallon, the greater proportion of which was carbonate of lime, which he maintained was essential to the development of bone in animal life. Quotations had been made from the report of Dr. Hassall, as to the quantity of organic matter contained in the Thames water from samples taken from Teddington-lock down as low as London-bridge. The evidence given by one of the chemical witnesses was that in a gallon of water taken from Teddington-lock, he discovered 5 grains out of the 70,000 of organic matter. Upon further questions being put, it turned out that that was the result of the analysis of the average of water taken throughout the whole distance mentioned. A chemical witness was asked, "How much of organic matter did you discover in the water taken actually from Teddington-lock?" The reply was, "One and a half grains out of the 70,000." He (Mr. Braithwaite) asked the meeting seriously to look at this question. They had been told that they ought to drink spring water. He was at a loss to understand what was meant by the term "spring water." He had brought with him the results of analyses, and he hoped he should not give offence by laying the same before the meeting, because his sole object in attending was a desire to gain instruction, and also to impart what information on this subject he was in possession of. He found that for a great number of years past, noblemen and gentlemen of all shades of political opinion, during their periods of office, drank the water of the Treasury pump; and, although that water was beautifully clear and limpid, and highly agreeable to the taste, it nevertheless contained no less than from fifty to sixty grains per gallon of Dr. Clark's hardness. Yet they found the ministers flourishing; they did not hear of gout or other mischievous developments in the system arising from the use of that water; and he would say that almost all the finest land spring water pumped from the London wells was found to contain from 40 to 60 and even 100 grains of carbonate of lime to the gallon. The Thames was loudly complained of as a source for the water supply. In all valleys the waters must go more or less into the stream which intersected that valley; it was the same with the Thames. He was not prepared to condemn the patent of Dr. Clark. If he wanted to wash, he did not want lime in the water; if he wanted to make tea, he did not require to have lime in the water; in fact, for anything of a chemical purpose, Dr. Clark's process was, no doubt, a very valuable and useful one; but to tell them they were to precipitate the chalk and lime in water for all purposes was, he thought, using the term respectfully, ridiculous. It appeared that up to the present time, the Plumstead Water Works was the only place where they could find this pure and beautiful water that was so much recommended by the author of the paper. He had paid great attention, not only to the sources of water supplied to the metropolis, but also to the chemical condition of those waters, and it had been his misfortune to differ widely from chemists, chiefly from the fact that, the chemists differed widely amongst themselves on the subject. The observations of Dr. Clark in the paper read, applied to "the chalk waters around the metropolis." The metropolis itself was excluded from notice as regarded the chalk waters. They had under London perfectly soft water. If they pumped water from a considerable depth below London, so far from its containing 8 per cent. of hardness, there was, in fact, no carbonate of lime in it at all; but they had a large amount of carbonate of soda, sulphate of soda, and other salts in solution—even to an extent that was said by Dr. Clark to act medicinally upon the kidneys.

TABLE SHEWING THE ANALYSES OF THE THAMES CHALK AND OTHER WELL WATERS.

SALINE AND OTHER MATTERS IN ONE IMPERIAL GALLON OF 70,000 GRAINS.	Graham, 1844.			Brande, 1846.			Phillips, 1849.			Bostock, 1834.	Beale, 1841.		Campbell and Clark.		College, 1856.
	Greenwich Hospital.	Page's Well, Greenwich.	Lambert's Well, Deptford.	Brewery, London.	Trafalgar-square.	Royal Mint.	Camden-town Station.	Watford Station.	Tring Station.	Treasury Pump.	Roberts, Roehampton.	Roberts, Roehampton.	Trafalgar-square.	Trafalgar-square.	Trafalgar-square.
Carbonate of Lime	19.08	21.23	16.74	6.2	3.1	1.5	...	19.54	14.72	34.3	48.0	24.0	2.74	...	3.2764
Carbonate of Soda	...	...	...	11.7	14.6	12.0	17.60	...	...	...	...	...	10.58	...	16.2949
Bicarbonate of Soda	...	...	...	...	...	...	...	...	...	...	...	...	...	28.5	...
Sulphate of Soda	3.62	0.60	2.67	24.2	19.6	18.1	13.0	...	...	...	8.0	8.0	21.34	...	8.7493
Sulphate of Potash	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13.6710
Sulphate of Lime	0.52	...	...	...	...	...	...	0.94	1.09	16.1	32.0	24.0	...	...	...
Chloride of Sodium	0.37	3.12	1.91	12.7	25.7	8.3	11.10	1.90	1.38	12.6	16.0	8.0	19.04	...	20.0583
Carbonate of Magnesia	...	...	0.84	1.1	2.4	...	...	...	...	...	...	...	2.07	...	2.2540
Sulphate of Magnesia	2.04	2.88	2.75	...	...	...	...	...	...	...	...	...	...	51.3	...
Carbonaceous Matter	...	...	...	...	...	...	2.30	1.32	1.61	...	...	...	...	...	...
Silica	...	...	...	0.4	0.7	...	...	...	...	...	...	...	0.40	...	0.9718
Phosphates	...	...	...	0.4	t	t	...	...	...	...	...	...	0 97	...	0.0210
Loss	1.67	...	1.33	...	...	...	...	...	...	...	...	...	0.66	...	...
Carbonate of Potash	...	...	...	...	...	...	...	...	...	...	...	...	1.05	...	...
Total	27.30	27.83	26.24	56.7	66.1	39.9	44.00	23.70	18.80	63.0	104.0	64.0	58.85	79.8	67.2798

The above table showed the results of various analyses of the so-called chalk water made by different chemists, and all differing in their results. He might mention the names of Prof. Brande, Dr. Clark, the College of Chemistry, Mr. Phillips, Mr. Dugald Campbell—in each of whose analyses there was a very wide difference as to the chemical composition of the water. It was, therefore, only fair to ask for some explanation on this subject. As he had before remarked, Dr. Clark, in his paper, had dwelt upon the matters *around* London. He (Mr. Braithwaite) wanted to know, if he could produce them water in London free from carbonate of lime, why they should pass a sweeping condemnation upon the Thames as a source for the supply of water to the metropolis. Dr. Clark had said, taking the water of the Trafalgar-square well, he found 79 grains of solid matter to the gallon, consisting principally of soda salts. Mr. Dugald Campbell had put the quantity at 58 grains, the College of Chemistry at 66 grains, and the College analysis appeared to be extremely minute, inasmuch as it was carried to six places of decimals. Prof. Brande stated that he found 66 grains of solid matter in that water. What he (Mr. Braithwaite) wanted to know was—and he had expected Dr. Clark would have stated it in his paper—what better source than the Thames they could go to? because, taking the 23 or 24 grains of solid matter to the 70,000 grains of water, he knew of no other water so good. They ought not to alarm the public by saying that in drinking the Thames water they were liable to be poisoned. He could tell them that, from an analysis ordered by Government, a gallon of water taken at the present time from Teddington lock did not contain more than 1½ grains of organic matter to the 70,000 grains of water, so that they might go home relieved of the unpleasant idea that they were going to be poisoned from drinking the Thames water.

Dr. LANKESTER stated that he thought, in consequence of the still imperfect nature of the water supply in London, that Dr. Clark was justified in calling the attention of the public to his method of purifying water, and that the Society of Arts was to be commended for having permitted his paper to be read. He first alluded to the objection which had been raised to Dr. Clark's process, as taking away lime from the water, and which was probably necessary for forming the bony and other structures of the human body. In answer to this, he stated that in many towns of the kingdom water perfectly free from carbonate of lime was habitually drunk, and had been drunk from time immemorial, and yet no softening of the bones or other injurious effects had been produced. The fact was, that carbonate of lime, although present to a certain extent in the bones of animals, was not the salt of lime they needed, which was the phosphate, and which was seldom found in water at all. It was another question as to whether carbonate of lime did any harm when taken in large quantities. There was evidence to prove that it was injurious, and most physiologists were agreed that pure water was the best for securing the health of animals and man. It had been stated that the organic matter in the Thames was in too small quantities to do any harm. It was impossible to say how small a quantity of organic matter in a state of fermentation might not do harm. A very minute quantity of organic matter present in water containing soluble sulphates was sufficient to decompose them, and render the water offensive from the discharge of sulphuretted hydrogen. This had even led the late Professor Daniell to conclude that the water of the Niger and the sea water off the coast of Africa contained sulphuretted hydrogen. In the water of the pump in Broad-street, Golden square, which he had investigated, only very small quantities of organic matter could be found, yet there was no doubt that the organic matter of this water was in such a state between the 1st and 3rd of September, 1854, as either directly to communicate or predispose to take the cholera to upwards of 500 people who partook of that water. The last speaker had begged the Society not to listen to "microscopic twaddle," but he (Dr. Lankester) begged the Society to attend to the results of microscopical investigation. A quantity of organic matter, not appreciable by chemical analysis, could be made abundantly evident by the aid of the microscope, and the forms of minute animal and vegetable life, which could alone be detected by the microscope, were frequently more characteristic of the impurity of water and its unfitness for dietetical purposes than any chemical analysis. The advantage of Dr. Clark's process in purifying water for cooking, washing, and manufacturing purposes, was admitted by all, but it had this additional recommendation, that it took away the source of organic impurities. It was the carbonic acid which favoured the growth of plants, and these were followed by animals which subsequently died, and led to much impurity. The carbonic acid being removed by Dr. Clark's process, stopped at least one source of the impurity of water. It was a sad reflection that after all the complicated arrangements for the supply of water to the metropolis, there was no general supply of water that could be guaranteed as free from impurity, and even occasional danger to life. The Thames, both above and below Teddington lock, was the recipient of all the filth from the vast population of the valley through which it flowed, and no efficient means of purifying it had yet been adopted. It was only fit for scrubbing, washing, and flushing the sewers, and he would suggest that means should be taken for supplying in small pipes, for drinking purposes alone, some of the pure spring water at a distance from the metropolis. He was glad to find that Dr. Clark's process had so perfectly succeeded at Plumstead, as it led to the hope that attempts would be made to bring water of equal purity to the large population of London.

Mr. Rawlinson inquired whether any particular description of burnt lime was necessary for the process?

Mr. Homersham replied, that all kinds of lime would not do. The description he used was the flare lime, from the upper chalk, near Gravesend. There was a lower bed of the chalk, known as the grey lime, which contained clay; that would not do, as the clay would contaminate the water. The cheapest lime that could be procured was the upper chalk lime, and that was applicable for the purpose. He (Mr. Homersham) had had it analysed, and found that it contained 98 per cent. of pure carbonate of lime.

Mr. Rawlinson further inquired whether the process could been carried on in, or was affected by, air and light, and whether it was necessary to be carried on in a closed reservoir?

Mr. Homersham replied, that it could be conducted either in a light or a dark, or in a covered or an open reservoir.

Mr. Rawlinson mentioned that in Manchester the water was under 2 degrees of hardness; in Lancaster, it was under 1½ degrees of hardness; and in Keswick, where he was at present constructing water-works, the water was under half a degree of hardness. He had not heard of any complaints of the use of soft water for drinking purposes. People accustomed to hard water considered soft water at first vapid and tasteless, but when they became habituated to it they approved of it; and when they left their homes, and drank hard water, it was offensive to the palate.

Mr. Evans remarked that, with regard to Dr. Clark's process, it certainly would appear that it was very efficacious in removing a large proportion of the lime usually held in solution in spring and river waters, and that such a subject would appear to be a legitimate one to bring under the notice of this Society. But what he had to complain of was, that Dr. Clark brought this scheme as only applicable to spring water, and as a round-about means of again bringing Mr. Homersham's Watford spring-water plan under the notice of the public. He, therefore, called the attention of the meeting to the fact that if it was valuable for spring water, and was capable of removing the organic impurities of decomposing chalk-water, it would be equally applicable to the lesser impurities of the water supplied by existing companies, and there was no need of seeking for fresh sources of water-supply for the metropolis, on which to bring Dr. Clark's process into operation.

Dr. Robert Dundas Thomson, F.R.S. (Medical Officer of Health for St. Marylebone, and Professor of Chemistry at St. Thomas's Hospital), regretted that a preceding speaker, eminent as an engineer, should have led the discussion aside into physiological subjects, for which the Society of Arts was not the proper arena. The invitation which he had received was not to discuss the proper source of lime for animals, but whether the process of Dr. Clark (and it was admitted by all who had addressed the meeting to be a beautiful one) was applicable for the removal of chalk and organic matter from waters capable of being supplied to the metropolis. When, during the invasion of cholera in 1854, he had to report to Government on the sanitary condition of the waters of London, he had considered it proper to study the invention as carried out so successfully at Plumstead, and he had satisfied himself that the process was not only excellent in theory, but likewise admirable in practice; and he could have wished that engineers, instead of travelling out of their province, and advising as to the physiological questions involved in the subject of food, had been prepared, by a careful study of the process, to point out any difficulties as to its application, or to suggest facilities for adapting it to the improvement generally of waters impregnated with chalk and organic matter, such as those of the metropolis. There could be no doubt that the process successfully removed chalk, and several chemists, qualified to express an opinion, had affirmed, from their experiments, that organic matter was likewise separated from the water by the use of the liming process. It was often asserted by non-medical participators in this discussion, that the small portion of organic matter in Thames water could not act injuriously to health. This, however, was a physiological question, and could only be argued legitimately in a Medical Society. But even in a popular meeting it could be understood that minute quantities of organic matter were capable of producing extensive results, for who could weigh or estimate the infinitesimal or imponderable portion of organic vaccine matter with which we inoculated our patients, and which was yet capable of influencing a whole community. The chemist found in Thames water ammonia and nitric acid, which, it was true, were not dangerous in themselves, but they were proofs, when present beyond certain limits, that the river was contaminated from the foulest sources with organic matter. He trusted that the meeting would not lose sight of the main object of the paper, which was an all important one in a sanitary point of view, by the foreign matter which had been introduced into the discussion. He had been astonished to find that when he was engaged, in 1854, in examining the process of Dr. Clark, he had not met with any engineer connected with water works who had examined the Plumstead successful experiment, or who was even aware of its existence, and he had never heard any reason assigned for the neglect of the process by the water companies, although competent chemical authorities had reported favourably as to the applicability of the invention to the purification of the Thames water.

Dr. Miller, F.R.S. said, having had an opportunity of witnessing experiments on the purification of water by Dr. Clark's process on a large scale, it might not be without interest if he stated one or two of the results obtained. He had seen Dr. Clark's process applied both to the water of the Thames and the water as raised from the well at Plumstead. A great deal had been said as to the importance of clearing the water, not only of the lime, but also of the organic matters present in the Thames water. It was quite certain that this process as applied to the Thames water, removed a large portion of organic matter as well as of chalk, and he had seen the experiment tried upon 3,000,000 gallons at Chelsea; on three different occasions a day's consumption of water at Chelsea was subjected to Dr. Clark's process. A specimen of the water was taken before the lime was added, and also a specimen after the water had rested in the reservoir for twenty-four hours. The water was examined for organic matter after the lime had been added, when it was found that the quantity of organic matter had been reduced to one-third of what it was before the lime was added,* whilst the precipitate was of a decided brown colour, in consequence of the organic matter carried down with it. Therefore, as applied to Thames water, he would state that the process not only removed the chalk, but, to a very considerable degree, reduced the amount of organic matter contained in the water. There was, however, one objection to the use of lime as applied to Thames water, but he did not regard it as an insuperable objection, which was, that on the application of lime, the water required a longer period of time to become clear, and, if there was any clay in suspension, it would not become perfectly clear upon the application of lime. He would further state that he had seen the process of Dr. Clark in operation at Plumstead, and was much gratified at the appearance of the water. It was bright before the lime was applied, but, after the process, it was extremely bright, had an excellent taste, and was reduced in hardness to the extent stated. He would say one word with regard to the use of lime. It had been debated that evening whether it was advantageous to remove the chalk from water. No doubt salts of lime in certain proportions were essential to animal life and the proper development of the frame. They could not exist without lime in some shape, either in their drink or their food, but it was another question whether it was desirable to supply it in the water they drank. There was scarcely an article of food that they took in which lime was not present. Every piece of bread they ate contained lime, and in most kinds of human food a larger quantity of lime was contained than was necessary for the preservation of life. A quantity of lime was removed from the water by this process, but it was very trifling in amount compared with what was introduced into the animal system from other sources than the water they drank.

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* It was subsequently explained, that this referred to matter *in solution*, not merely to that in suspension.

Mr. Dugald Campbell, F.C.S., said he would, if allowed, take up the subject of discussion at the point last touched upon by Dr. Miller, which was the supply of lime salts to the bones in the body. He thought it had escaped the notice of the previous speakers to mention that the phosphate of lime was the salt of lime essential to the support of the bones in the body. In the bread, in the vegetables, and in the meat which we ate, there was an abundant supply of that salt—the salt proper, as it might be called, for that duty—whereas water, as a rule, contained none of it. The principal lime salt usually found in water was the carbonate, and this salt bore a small proportion to the other salt of lime in the bones, as Dr. Lankester had truly observed, and he (Mr. Campbell) thought, need not essentially be supplied by the water, as carbonate of lime was in superabundance in the substances supplying the phosphate of lime, and might be assimilated at the same time along with it. He had frequently witnessed the process of Dr. Clark at the Plumstead Water Works, where it had been applied with such great success by Mr. Homersham, the engineer to the company. He happened to be there a few days after the company had tried the experiment of supplying the unsoftened water to the consumers, which was alluded to by Dr. Clark in his paper, and he regretted to witness those reservoirs, which he had previously seen free from vegetation, then covered with vegetation of a decidedly obnoxious appearance and odour, which was sure to arise in all chalk waters left unsoftened and exposed to light and air in warm weather. He had witnessed on a large scale the application of Dr. Clark's process to the Thames water, and had softened it himself on many occasions, but although, under all circumstances, it greatly improved the water, yet, to apply the process to the greatest advantage, the water should be previously filtered, and even then, after the trouble and expense of filtration, the water softened was not equal to water softened direct from wells, which needed no filtration. Rather more than twelvemonths back he took up a number of the *Comptes Rendus*, a very well known French scientific journal, and seeing a title inviting to him, which was "A new Method of Analysing Waters for Household Purposes," by MM. Boutron and Boudet, he began to peruse it with great avidity. As he read he found described, word for word, Dr. Clark's method for testing water to guide persons in applying his softening process, all of which was published to the world fifteen years back. He thought of course to come to the words, "this is the process of Dr. Clark, and now we will describe ours," but no, Dr. Clark's name was not mentioned, but MM. Boutron and Boudet claimed the method, without the slighest reserve, as their own. This astonished him, but what surprised him more,—for he thought the French men of science, as well as those of this country, must know the process as being Dr. Clark's,—was being told by Dr. Hofmann, some little time ago, that the French Academy had awarded to these two gentlemen a prize of about 2,000 frs. for this discovery. The award to these gentlemen was a mistake on the part of the French Academy, but it showed how the Academy, composed of the highest talent of France, appreciated the value of the discovery, by distinguishing it with a prize within twelve months after its production. It might be observed that this was only one-half of Dr. Clark's invention, and the smallest half, perhaps, in many ways, all o which, as stated before, had been open to this country for fifteen years, yet it had received no prize, and, as yet, had only been embraced by one solitary public company.

Dr. Hofmann, F.R.S., said, he could confirm in every respect the statement of Mr. Dugald Campbell. The beautiful process of analysing water by means of an alcoholic solution of soap, a process which had been universally in use in this country for the last ten years at least, had been rediscovered in France. This event took place on the 26th of March last year, when Messrs. Boutron, Chalard, and Boudet communicated a note on this subject to the French Academy. The communication of these gentlemen, the essence of which was Dr. Clark's process, for which they claimed, however, a more extended application, attracted much notice in France, and on the 28th of January last, the Academy voted them a recompense for their invention, consisting of 2,000frs., to be taken from funds left at their disposal by Mr. Montgon, (*Prix Montgon relatifs aux Arts insalubres*). The reward was made in the following terms:—"*D'accorder un prix de 2,000f. à MM. Boutron et Boudet, pour leur moyen de determiner la proportion des sels à base de chaux et de magnésie dans les eaux des Sourres et des rivières au moyen d'une liqueur savoneuse titrée.*" This proceeding might appear strange perhaps, but he (Dr. Hofmann) had not the slightest doubt that the process had been actually invented again by Messrs. Boutron and Boudet, who had remained perfectly unacquainted with what Dr. Clark had done previously. This would be readily intelligible to those who knew how little public attention in France, and on the Continent in general, had been, until recently, directed to the question of water supply to towns, and to the means of purifying water for domestic purposes. As to the award made by the French Academy, it was nothing but a recognition on their part of a most useful and elegant process, and had they been aware of the general use of this process in this country they would have doubtless done ample justice to Dr. Clark. Even now it was not too late, and he believed it would only be necessary for Dr. Clark to submit a simple *reclamation* to the French academicians, as a more conscientious, just and liberal body of men could not be found. Such a step, he had no doubt, would be highly acceptable to Messrs. Boutron and Boudet, who he was persuaded had no wish to claim anything which was not due to them. It would be appreciated equally by the Academy, who would be thus afforded the means of healing a wound which they had unintentionally inflicted. He would strongly urge Dr. Clark to take this step, which would settle this matter in a manner satisfactory to all parties. With regard to the subject more immediately under discussion that evening, he could add but little to the able remarks which had already been made. He had himself witnessed Dr. Clark's process on a very large scale, both at the Chelsea Water Works with Thames water, and at Plumstead, and he could bear testimony to the remarkable results obtained by this elegant process. A great advantage of Dr. Clark's method consisted in the removal of the lime, but a much more important feature was the removal of organic matter from the waters, or at all events, the reduction of the organic matter invariably present in water, to a condition in which the water was incapable of undergoing putrefaction under the influence of a high temperature. He had himself observed a diminution of the organic matter in consequence of the softening process; he could also testify to the remarkable absence of confervæ in the softened water of the Plumstead Water Company, but he was not at present prepared to give a definite opinion regarding the perfect success of the process in the removal of the total amount of organic matter. He might state, in conclusion, that in his opinion, the fear entertained by many persons with regard to the present supply of water to the metropolis, was somewhat exaggerated. He had himself had frequent opportunities of examining the present supply, and was at present engaged in an extensive series of experiments, undertaken under the auspices of the President of the General Board of Health, embracing the waters of all the companies taken at regular intervals, so as to obtain an idea of their composition in the different periods of the year. Without entering into details, he might state that the results obtained up to the present moment, which referred to the composition of the water during the winter months, had been very satisfactory. It remained, however, to be seen in what manner the composition of the water would be affected by exposure to the high temperature of the summer months.

Mr. BEARDMORE remarked, that in discussing the best means of affording a pure supply of water to the metropolis, due regard must be had to its position in the centre of a great basin entirely encircled by chalk hills, from which poured, in every direction, rivers composed of springs rising directly out of the chalk, the chief bulk and volume of which lay within twenty-five miles of St. Paul's. It was no doubt natural enough for people to cry out at the impurity of the Thames, seeing the state in which it flowed through the metropolis, owing to the sewerage proceedings of the past ten years—but it did not follow because such was the case below Teddington, that the chalk springs formed to any less degree the main volume of the river above that point. Since 1853, the companies had, in deference to public opinion, removed their points of draught, improved their works, and applied the most practicable means of purification yet known, on the broad and immense scale which the demands of two millions of people required. The monies spent upon these great operations would exceed fifteen hundred thousand pounds sterling; a sum which, first or last, would fall upon the householders for repayment, and it therefore became a matter of discretion how far the beau ideal of purity could be economically attained. He would not, therefore, either encourage or discourage the consideration of the author's very ingenious process, deeming it to be just one of those inventions which rested upon the debateable ground between theory and practice. The supply of water to towns was always a geological and geographical question in connection with the economical application of capital, and it therefore would be equally just and necessary that Manchester, or Carlisle, or Plymouth should drink water containing two or three grains of carbonate of lime per gallon, as that the towns on tertiary formations should consume water with twelve grains of that salt in a gallon. He was surprised at the want of knowledge of the locality shown by a remark in the paper on the New River Company's source of supply from the River Lea. The meeting might, perhaps, be informed that the entire body of that river was, for all practical purposes, pure spring water, and differed to no appreciable extent from the Chadwell spring, which formed only from one-sixth to one-eighth part of the present requirements of the New River Company's district. The River Lea was formed, to the extent of four-fifths of its entire volume, of chalk springs, rising either in its bed or within a few yards of its banks—the sole exception to the case being during times of flood, when artificial aid in the purification of waters was at all times more particularly required, and to which object the enormous expenditure of the companies was largely devoted. Any mention of the supply of the metropolis from the Thames must, therefore, admit this qualification—that the area supplied with water taken from the Lea at points from 14 to 22 miles above its junction with that river was girt by a line extending from Charing Cross to Highgate—from Highgate to Tottenham, from Tottenham to the new town springing up at the Victoria Docks, and thence along the Thames shore line, all the way up to Whitehall stairs—a circle which embraced no mean proportion of the urban and suburban metropolis, whether as regarded extent or population.

The Rev. J. C. CLUTTERBUCK had been acquainted with Dr. Clark and his process for softening water for nearly fifteen years. He then tried the experiment himself, and forwarded many samples of water from Hertfordshire to Dr. Clark for examination. He could not persuade his servants that there was so much difference in the water as he was led to expect, though he was willing to attribute this to his want of skill in the experiments. He had lately heard it observed, that in all the places which of old were famous for their beer, the water was either from the chalk, or else was highly charged with carbonate or sulphate of lime, so that it had been suggested that where these substances were wanting it would be well to introduce them artificially. This was a fact he thought worthy of notice. With reference to the natural supply of water to London, it was mostly from the chalk; even the river Thames, which rose in the oolitic hills of Gloucestershire, and then passed over the clay districts, (where it became charged at times with the impurities from flood waters,) received the greatest part of its perennial waters from the chalk. On a recent occasion, when the waters were very low, there was so little water above Pangbourn that at that place all the gates of the lock could be opened at one time, showing how very little perennial water came from the upper districts; thus the Thames was a water well fitted to be dealt with according to Dr. Clark's process, if it were deemed advisable to incur the great expense it would entail on the water companies, and for which the public must pay. It appeared to him that the statements of the paper with reference to the removal of organic matter were not sufficiently explicit or detailed. Some light had been thrown on this point in the discussion by a previous speaker, but the meeting was not told in the paper how the removal of organic matter was effected. The carbonate of lime was removed by a chemical action of the lime, or lime-water, on that substance. This was thoroughly explained. But we were not told whether the removal of the organic matter was confined to that held in suspension, and so carried down by the gradual deposition of the chalk or lime, or whether its removal was by some chemical action. Mr. Clutterbuck thought that this was a point well worth attention, and which required elucidation, because, as had been argued, the presence of organic matter was much more dangerous, and either directly or indirectly more deleterious than the presence of carbonate of lime, to the removal of which it was generally supposed that the process was confined. If Dr. Clark could prove that organic matter was effectually removed from water by his process, it would be impossible to over-value the discovery or the benefits of its application.

Mr. W. FOTHERGILL COOKE would mention a fact, which he took from an official report by Mr. Wicksteed, as to the disinfecting action of that gentleman's process upon the entire sewage of Leicester during many months. The organic and mineral matter deposited by the cream of lime was about one part in 1,100, including the lime employed. The effluent water was almost entirely free from taste, and frequently from colour, and very soft and in a drinkable state. It was believed to be nearly as pure as the average drinking water of London, which contains 23 grains in a gallon or in 70,000 grains, or 1 in about 3,000. The conclusion, therefore, would be that the sewage of Leicester was only four times more charged with separable matter than the drinking water of London. The dry solid sewage separated at the works during the last nine months was about 3,000 tons, from 3,400,000 tons of sewage.

Mr. FREDERICK BRAITHWAITE wished to say, in explanation, that Mr. Cooke had omitted one important element in the comparison he had brought forward of Mr. Wicksteed's sewage water and the water used for drinking purposes in the metropolis. If he took away the 20 grains of lime, there would only be left 1½ grains of solid matter per gallon in the London water. In the remarks he had offered he had not wished to detract in the smallest degree from the merits of Dr. Clark's process. For all matters of washing, dyeing, and brewing, indeed, for all culinary purposes, there could be no question but that it was valuable in the extreme.

The CHAIRMAN said he was reminded by the Secretary that the time had arrived at which—however willing some of them might be to continue to listen to the important observations that were being made—this discussion must be closed. It would be unpardonable in him, who could add but little to the information already given, to detain the meeting with many remarks. The only part of the subject on which he would say a few words, was that which had already been touched upon by a distinguished member of his (the chairman's) own profession, Dr. Lankester, but which otherwise had, perhaps, received less attention than its importance deserved—that was, the *real value to human life* of the project of Dr. Clark, supposing its adoption to be chemically and mechanically feasible. Dr. Clark proposed to free water from hardness and from organic impurities. First of all, as to freeing it from hardness. Was hardness in water in any degree hurtful to life? That was a subject on which he could not speak dogmatically, but he would contribute his humble testimony towards relieving the meeting from whatever anxiety had been occasioned by the speech of Mr. Braithwaite. Was there any chance of their bones failing them in case soft water drinking should be resorted to? He thought he might say evidence on that subject had been adduced sufficient to satisfy Mr. Braithwaite's mind that his position was not tenable, inasmuch as large populations had been mentioned who habitually consumed soft water—in Aberdeen, in Manchester, in Lancaster and elsewhere—populations certainly showing no deficiency of bone. Experiment was, indeed, the final test in these matters: but, let the experiment be a sufficient one. The conclusion which had been drawn from Professor Liebig's cartilaginous calf evidently was inadmissible. Myriads of cattle throve on soft water. The skeleton of any one of them might be confidently produced to meet the argument of Liebig's boneless calf. Take much of the Highland cattle, for example; they had well-formed bones, and were not obliged to be supported on calves-foot jelly. The fear was evidently groundless that the human body could be starved of lime by the mere absence of that material from the drinking-water. Plenty of lime was to be found in other ingredients of human food; and for the most part it occurred in our solid food, in a more immediately available form than in water. He was not prepared to say that they had as yet any very definite evidence on the question whether hard water was in itself injurious to health; there was hitherto a want of that sort of proof with which a physiologist ought to satisfy himself; but of the domestic and economical advantages of soft water there could, he believed, be no doubt. As regarded the other matter—the freeing of water from organic impurities—he must say that, if Dr. Clark could realise that promise, he would have fulfilled an important object for human life. Mr. Clutterbuck had raised a question, not previously mooted in the discussion, but which was of essential importance. It was one on which Dr. Clark had not supplied any definite information. The liming process was described as clearing the water of organic impurities. No doubt it would have that effect upon such organic matters as were held in suspension. But did it free the water from organic matters not in suspension, but in solution?

Dr. MILLER stated it was used at the print works in Manchester for that very purpose.

The CHAIRMAN said, that as regarded the most objectionable impregnation of organic matter (that which would be occasioned by an admixture of town drainage), so late as that day he had asked a friend, who was now present, and whom he had hoped to hear speak on the subject, Mr. Taylor, to investigate this point. This gentleman informed him that he had applied Dr. Clark's process to water having those qualities that were attributed to the worst conditions of Thames water; that, after liming, he had filtered it; that it had passed the filter quite clear, but still preserving a very unmistakable smell, and when evaporated giving evidence of the presence of organic matter. All suspended organic matters, and all colouring matter, had been removed by the liming process; but the water retained offensive qualities, and still contained sewage ingredients liable to putrefactive changes. That was the real danger which he (the chairman) apprehended in many of those waters in which the public of large cities were most interested. Organic admixtures in water were various, and of course not all of equal importance. In some cases the material might be of a kind or in a state importing no danger to health; but when of a kind easily putrifiable, he suspected it was extremely dangerous; and when this putrifiable quality was derived from the drainage of towns (when, in fact, it represented the decomposition of sewage) he suspected the danger reached its maximum. He could quote to them the results of a gigantic experiment which had been undesignedly conducted on half a million of human beings, and which would set this fact in a strong light. It happened that in the last epidemic of cholera, a certain half million of population dwelling contiguously over one large area were drinking different waters; some from private wells, but the larger number (about four-fifths of the whole) from two commercial supplies. There were the mains of two rival water companies going through the district, often literally side by side; one company supplying nearly 25,000 houses, the other nearly 40,000; so that in this vast experiment there were immense masses of population living, as far as could be judged, in all respects alike, except as to the one difference of their water supply only. And that difference was, that one company drew its water from high up the Thames, where it was of comparative excellence, while the other drew its water from low down the river, where it was profusely contaminated with town-drainage. Among the population to which he alluded, there were in 1853-4 more than 4,000 deaths from cholera; and when the epidemic had subsided, an inquiry was made, house by house, as to those deaths, and as to the water-supply of the several houses where they had occurred. The inquiry was conducted with every precaution, to avoid sources of fallacy; and the result was this: In the one set of houses the mortality per 10,000 of the population was 37; in the other set of houses it was 130, that is to say, the cholera death-rate was 3½ times as great in the one set as in the other. It also fortunately happened in this very decisive case that further information could be procured, so as to present almost a duplicate experiment. The returns of the Registrar-General had made it possible to ascertain the mortality during the preceding epidemic of cholera—that of 1848-9. Going back to that period, it was found that the mortality from cholera was about equal in the two groups of houses. The mortality per 10,000 of population was in the one case 125 and in the other 118. The tenantry which in the epidemic of 1853-4 suffered a cholera death-rate of only 37, had in 1848-9 suffered a death-rate of 125, and why? At that time, instead of drawing a comparatively pure supply from high up the river, it was drawing from nearly the same source as that other company which, on the late occasion, contrasted so unfavourably with it. Now, these unintended experiments had been on so large a scale that they might be considered conclusive, and as the difference between the two waters in question was only that one of them contained a large admixture of town drainage, they might be considered to establish the extremely dangerous tendency of this contamination during periods of epidemic cholera. Among the population supplied with foul water, the death-rate was three or three-and-a-half times greater than among those who had the advantage of a more wholesome supply. With this fact before them, the importance of Dr. Clark's project could not be mistaken. If they were to continue the use of waters liable, in however small a degree, to such admixtures, there could be no doubt that any available process which would thoroughly withdraw such organic impurities, would be an invaluable boon to society. Having referred to the water-supply of a particular company as the hurtful agent in that large experiment which he had described, he now begged in conclusion, to assure the meeting that they need entertain no apprehension of being injured by the further distribution of that water which, during the two epidemics of cholera, did doubtless cause a great destruction of human life; for, happily, it was no longer furnished; the company had now, for some months past, altered thieir source of supply, and were at this moment distributing a water widely different from that which had been the subject of his remarks.

A vote of thanks having been passed to Dr. Clark for his paper,

The Secretary announced that there would be an Extra-Ordinary meeting on the evening of Friday, the 16th inst., for the purpose of resuming the discussion upon Mr. Braidwood's Paper on "Fires and Fire-proof Structures." John Thwaites, Esq., Chairman of the Metropolitan Board of Works, will preside, as on the last occasion. Also, that the Paper to be read on the evening of Wednesday next, the 21st inst., was, "The British Silk Manufacture, its Condition and Prospects as Compared with that of other Countries," by Mr. T. Winkworth. On this evening T. F. Gibson, Esq., F.G.S., will preside.

Mr. W. Bridges Adams, in a note to the Secretary, subsequent to the meeting, on "Pure Water and Railway Locomotives," says, "In the paper on pure water, by Professor Clark, read this evening, there was no mention either in that or in the subsequent discussion, of one very important branch of the subject—the applicability of Professor Clark's system to the purification of water for railway locomotives. It is probable that the duration of boilers and the production of steam, *quoad* the fuel consumed, are lessened from one-half to two-thirds by lime deposits. Organic matter is of little consequence for such uses, for the best known water in practice is the water of peat bogs, containing tar and other matters. With pure water, the boiler would scarcely ever need blowing off or washing out, and tubes and piston would be saved from burning. Many plans have been prepared and tried for preventing incrustation in boilers, by trying to alter, chemically, the condition of the water when in the boiler, but, unfortunately, with the too frequent chemical result of altering the chemical condition of the metal composing the boiler. Using distilled water, or water freed from every ingredient not essential to the production of steam, would add very materially to the profits of the railway companies, and to the safety of their servants and the public. The process of Professor Clark could, at little expense, be adapted to all water stations, and probably would, were the railway authorities made aware of it. I think it would do good service, and be very likely to promote a useful object, if the number of the *Journal* with Mr. Clark's paper and discussion, were forwarded to every locomotive superintendent throughout the kingdom, as a common-sense process for saving coke, facilitating the production of steam, lessening wear in the boiler, diminishing the number of engines required, and leaving the hot water all night in the boiler, instead of blowing it off as waste. I have no doubt that it would pay, even to distil all the water before using it in the boiler, so great is the waste arising from the use of impure water. If, therefore, Professor Clark's process will accomplish this in so simple a manner, the saving will form no unimportant item in the dividends."

BRAKE FOR RAILWAY CARRIAGES.

Previous to the reading of the paper on Wednesday evening, the Secretary called attention to a model of a brake for railway carriages, by Mr. George S. Parkinson, which was placed on the table. This invention consists in attaching a fixed and a moveable "clutch" on one of the axles of a railway carriage, and to the collar of the moveable clutch is attached a cam. The moveable clutch is put in or out of gear by means of a long rod, working a system of levers. The rod is worked from the guard's carriage by means of chains attached to a drum. The drum being made to revolve by a screw, worked under the control of the guard, the chains are wound up and the rods drawn, which, by means of the levers throughout the train, cause the moveable clutch on each carriage to be brought into gear with the fixed clutch. The cam attached to the moveable clutch is thus made, on every revolution of the axle, to press against a lever, by which the jambs of the break are brought to bear against the rim of the wheel, during a portion only of its revolution. By this arrangement the wearing of the wheel into "flats" as at present, is said to be prevented, and less destruction is caused to the rails and jambs. It is intended that this invention should be used on two carriages of a train at least, and it can also be applied to work on any number of carriages simultaneously.

ALUM.

(From Dr. Macgowan's Chinese Serial; as reprinted in the *North China Mail*, Feb. 23, 1856).

About eleven hundred tons of alum have been exported within a short period, chiefly to India. This mineral is largely employed by the Chinese in dyeing, and to some extent in paper-making, as with us. Surgeons apply it variously, after depriving it of its water of crystallisation; and in domestic life it is used for precipitating vegetable substances suspended in potable water. It is used also by the Chinese in a manner peculiar to themselves. Fishermen are usually provided with it; and when they take one of those huge Rizostoma which abound on the coast, they rub the animal with the pulverised styptic to give a degree of coherence to the gelatinous mass. Architects employ it as a cement in those airy bridges which span the watercourses. It is poured in a molten state into the interstices of the stones; and in structures not exposed to constant moisture the cohesion is perfect, but in damp situations it become a hydrate and crumbles, a fact of which the whole empire was officially informed by the government about thirty years ago. It was discovered that water had percolated into the mausoleum of Kiaking; having been built too near to the mountain side the alum cement imbibed moisture, segregated, and opened the way for it to enter the tomb. In those peaceful days such an event was of such importance as to call forth edicts and rescripts, memorials and reports, in succession for several months. The son-in-law of the deceased monarch, to whose care the construction of the edifice had been entrusted, was fined and degraded, and a statesman from Foh-kien, acquainted with the properties of alum, was appointed to remove it a short distance from the mountain.

Alum was first introduced into China from the West, and until a comparatively recent period the best kind, called sometimes Persian, and at others Roman alum, was brought from Western Asia. Numerous localities where an inferior article is manufactured are mentioned in the Pharmacopœia—viz., Shan-tung, Shan-se, Kiang-su, Hu-kwang, Sz'-chuen, also in the south-western frontier and in Tibet. That from Sz'-chuen is represented as having the property of converting iron into copper or of coating iron with copper, by placing the former metal in a solution of rice-liquor and alum the stone of that province. The most recent editions of works on materia medica contain no reference to the mines in this province, the products of which have surpassed in quality the foreign, and rendered its importation unnecessary. From this and from other circumstances it is certain that the works which we shall now describe have not been long in operation. They are in the Sung-yang hills, bordering on Foh-kien, in the district of Ping-yang, Wan-chau prefecture, and in close proximity to Peh-kwan harbour. (27degs. 9min. 10sec. N., 120degs. 32min. 6sec. E.)

The locality has been visited by one foreigner only, to whom we are indebted for most of the following particulars:—About two months ago he started from Chih-k'i bight, in Lannai harbour, to which Ningpo boats resort for this commodity to the northward of Peh-kwan. Three hours' hard walking over a succession of precipitous hills, crossed by stone steps and pathways, brought him to the mines. Ten alum-making establishments were in operation, which, with the exception of one on a hill opposite, occupied about a mile of the side of a lofty hill. The works were adjacent to the quarries from which the alum-stone seemed to crop out of decomposed rock of the same lithological character. The stones were thrown into a fire of brushwood, where they burnt with a slight lambent flame, and as they cracked the fragments were raked out, broken into small pieces, and macerated in vats. Subsequently the disintegrated mineral was thrown with water into a vessel, having an iron bottom and sides of wood, and boiled for a short time. The lexivium was then poured into large reservoirs, where it crystallised into a solid mass. Blocks of alum, weighing about 50 catties each, were hewn out of the reservoir and carried in this state, in bamboo frames, one on each end of a porter's pole, to the place of shipment, where it is broken into fragments. When not designed for immediate exportation the blocks are stored away for drying. On reaching the depôt the alum is found charged with a double quantity of moisture; the porters being obliged to deliver a certain weight, they slip their burdens in the mountain streams which they pass in the journey. Judging from the number of labourers engaged in transporting the mineral on the day of our informant's visit, the quantity brought from the works could not be less than eighteen tons. This was represented as less than an average day's work, as labour was in such demand just then for agricultural purposes that double pay was gven; and aged men and women, with boys and girls, were pressed into the service. Assuming that day's product as a basis for calculation, and making an allowance for rainy days, we may safely estimate the annual supply as between five and six thousand tons. The quantity consumed by the dyers of Ningpo prefecture alone, being nearly twenty-two tons per annum, is corroborative of this estimate. The supply is literally inexhaustible. Five dollars-and-a-quarter a ton at the landing would afford the manufacturer a fair profit. It often fetches much more, as there has been an increasing demand for the article, owing to the greater facilities afforded for exportation from Ningpo in foreign vessels.

The Wan-chau alum is equal to the best Roman;—a roseate tint in some specimens indicates the presence of minute quantities of iron.

We have no means of ascertaining the precise geological position of the rock from which this is alum procured; some circumstances seem to indicate it to be a new mineral. It is stated that no potash nor any other material is employed in the works. Granitic and porphyritic rocks abound in the vicinity, and some parts of the district produce iron and silver. According to the Wan-chau Topography the working of silver was discontinued in the reign of Wan-lih (1615), in consequence of imperial prohibition. This part of the coast has recently become the seat of extensive poppy cultivation, for the bane of the Chinese race.

As a contribution to the physical description of the alum district we would add that the typhoon of September last was preceded by a rising of water in wells and ponds many miles inland. When the cyclone reached the coast it submerged about a hundred square miles, occasioning a vast destruction of life and property. The waters of the sea were retained in the country by strong easterly winds for several days, leaving a strip of land bordering on the sea quite dry.

LISTS OF IRISH SOCIETIES.

It may be a matter of interest to many of the members to know the places in which Scientific and Literary Societies, and kindred Institutions, are situated in Ireland. Moreover, as it is believed that this enumeration is not to be found printed elsewhere, it may possibly, at some time or other, be found useful. Those marked with an asterisk (*) are in union with the Society of Arts, as is also the Dublin Statistical Society itself.

I.—*Corresponding Societies in connection with the Dublin Statistical Society.*

Ardee, Mechanics' Institute.
Armagh, Natural History and Philosophical Society.
Ballynahinch, Literary and Scientific Society.
Banbridge, Literary Institute.
*Belfast, Working Classes Association.
Belfast, Queen's College Literary and Scientific Society.
Belturbet, Literary and Scientific Society.
Carlow, Mechanics' Institute
Coleraine, Mechanics' Institute.
Cork, Cuvierian Society.
Cork, Literary and Scientific Society.
Downpatrick, Mechanics' Institute.
Drogheda, Mechanics' Institute.
Dublin, Mutual Improvement Society.
Dundalk, Mechanics' Institute.
Dungannon, Society for Promoting Literature, Science, and the Arts.
Enniskillen, Literary Society.
*Galway, Royal Institution.
Garvagh, Scientific Society.
Kilkenny, Literary and Scientific Institution.
Killyleagh, Literary Society.
Kilrea, Literary Society.
Limerick, Social Inquiry Society.
Lisburn, Literary Society.
Lurgan, Literary Society.
Mountmellick, Mutual Instruction Society.
Newry, Institute.
*Portaferry, Mechanics' Institute.
Wexford, Mechanics' Institute.

II.—*Societies* not *in connection with the Dublin Statistical Society.*

Belfast, Library Society.
Belfast, Literary Society.
Belfast, Natural History and Philosophical Society.
Belfast, Royal Society for the Promotion and Improvement of the Growth of Flax in Ireland.
*Clonmel, Mechanics' Institute.
*Cork, Royal Institution.
Dublin, College Historical Society.
Dublin, Geological Society.
Dublin, Natural History Society.
Dublin, Royal Dublin Society.
Dublin, Royal Agricultural Improvement Society of Ireland.
Dublin, Royal Irish Academy.
Dublin, Royal Zoological Society of Ireland.
Dublin, University Philosophical Society.
*Dundalk, Literary and Scientific Institution.
Limerick, Institution.
*Limerick, Literary and Scientific Society.
*Waterford, Mechanics' Institution.

Home Correspondence.

FIBRE GILDING.

Sir,—I am happy to be able to endorse the opinion expressed by Mr. Bennoch, in the *Journal of the Society of Arts*, of May 9, relative to the impetus likely to be given to fibre gilding in this country, and the manufacture of articles therefrom, since the commencement of the discussion of the subject in your *Journal*. The number of communications which I have received from firms of the highest respectability in various parts of the United Kingdom, clearly prove that the manufacturers are beginning to appreciate the importance of the matter, and are turning their attention to the means by which the markets of the East may be supplied from this country with articles suited to oriental taste and fashion. Indeed, it is matter of surprise to all persons with whom I have discussed the subject, and who are at all conversant with the matter, how so much apathy could so long have been felt by our usually enterprising manufacturers to a branch of trade the returns of which, as shown by the chairman of the East India Company, are to be reckoned by tens of millions annually.

Mr. Bennoch states, in reply to my former remarks, that in his paper he confined himself to "facts realized," and that he is not aware that any gilded thread, except that exhibited by himself at the rooms of the Society of Arts, had ever been perfected so as to become a "marketable commodity." Now, I need scarcely inform Mr. Bennoch, that it is one thing to realize a fact and another thing to supply the public with such results. The first depends upon the perfectness or simplicity of an invention, or the correctness of a principle; the latter upon pecuniary means or commercial connexions. The history of many of the finest inventions which ever emanated from the genius of man—even those which have tended to elevate Britain in the scale of nations—fully demonstrate this fact. Indeed, it may almost be taken as a rule that the inventor who, by the force of genius, of mechanical or scientific skill, of patient self-denying perseverance and unconquerable energy gives form and beauty to chaos, voice and power to the subtlest elements, who penetrates the earth, and from its teeming bosom brings forth hitherto hidden treasures, and in a thousand ways improves the condition of his fellow man, such a man, I say, is not, as a rule, the one to bring forth the results of his labours commercially before the world.

With regard to the opinion expressed by Mr. Bennoch that I wish to plume myself on the presumed fact of priority of invention, I would simply remark that such is not the case. My former remarks applied to this country, and I neither need nor desire to rest my claim to priority of invention upon any *presumption*, nor to plume myself with false claims.

As respects the relative qualities of the productions of Mr. Hock and myself, nothing could give me greater pleasure than to accept the challenge of Mr. Bennoch, and prove that my plan *is* superior to that of Mr. Hock, both as regards cost and facility of production, as also in brilliancy of effect. By Mr. Bennoch's own showing he is not able to produce a thread sufficiently bright to meet the requirements of existing tastes and fashion, but merely "a new and very expensive colour," whereas I am enabled to gild threads of any length, on either side, at *one operation*, and, at the same time, produce the highest degree of brilliancy of which gold or metal leaf is susceptible, such brilliancy being attained by means of highly polished steel rollers, as specially specified in my patent.

I cannot, however, but express my thanks to Mr. Bennoch for his disinterested attempts to arouse the manufactuters of Britain from their lethargy, and I hope and believe the time is not distant when the manufacture of Pugrees, Sarhees, Dupottas, and other articles suited to the Eastern markets, will become a staple trade of this country. With regard to the tinselled appearance now considered so necessary, I would observe that nothing is so capricious and evanescent as fashion. A frown or a smile from royalty may change it in a day, and I doubt not but a little energy and perseverance on the part of a few manufacturers of eminence, and the production of a new class of chaste designs, would wean the people of India from their present love of glitter, and create, in lieu thereof, a taste for the beautiful for its innate worth, while, at the same time, it would tend to awaken a greater taste for this class of articles in our own land.

I have, &c.,
WILLIAM GREEN.

57, York-street, City-road, London, May 12, 1856.

TONNAGE REGISTRATION.

Woolwich Dockyard, May 8, 1856.

Sir,—The following advertisement having been published in the *Times* newspaper:—

"The Tonnage of Ships.—For a comprehensive article on this subject, see the last four numbers of the *Mechanics' Magazine*, Nos. 1,705-6-7-8," and finding that the article referred to is a running criticism on the paper on "Tonnage Registration" read by me at the Society of Arts on the 16th of January last, and the discussions and correspondence thereon which have been published in the *Journal of the Society of Arts*, I beg the favour of your inserting, in your *Journal* for this week, the annexed letter which I have addressed to the Editor of the *Mechanics' Magazine*, intimating that I purpose, when the article referred to shall be complete, to respond as respects a few points on which my acknowledgments are due to the author thereof.

I am, Sir, your obedient servant,
CHARLES ATHERTON.

To the Editor of the Mechanics' Magazine.

Woolwich Dockyard, 6th May, 1856.

Sir,—Referring to the "Note on Tonnage Registration" in No. 1,708 of the *Mechanics' Magazine*, page 420, correcting the typographical errors that unfortunately pervaded the exposition given in No. 1,707 of Stirling's Formula for calculating the cubical contents of an irregular solid, or space, by means of rectangular co-ordinates referred to the circumscribing parallelopipedon, being an exposition of the rationale of the rule for tonnage admeasurement under the Merchant Shipping Act of 1854, your correspondent, on looking further into this matter, will doubtless observe that the list of typographical corrections, as given in No. 1,708, page 420, are still far from completely correcting the typographical errors of the formula referred to, as enunciated in No. 1,707, page 392, and as a second edition of such typographical corrections would be inconvenient, your readers, who may be giving attention to this subject, would probably be obliged by your reprinting the whole formula, duly revised and corrected, to facilitate their perusal thereof. I may further submit for your consideration that, by your introducing textually the rule for calculating tonnage, as deduced from the formula referred to, and prescribed by the Merchant Shipping Act of 1854, you would still more satisfactorily elucidate this matter. Permit me further to suggest, for your correspondent's consideration, whether in the text, explanatory of "what is meant by the curve of sections," there are not some further errors, either typographical or textual, not clearly expressing the intended sense of the text. I also beg to intimate that, when your article on the Merchant Shipping Registration Act, in exposition of my paper thereon, read before the Society of Arts on the 16th January, 1856, shall be completed, as I presume it will be on the correction of the typographical errors, I may probably request the favour of your inserting a few remarks from myself, referring to various points of your criticism on my paper, on which my acknowledgments are due to your anonymous correspondent, or perhaps to yourself, as the editor of the *Mechanics' Magazine*, and possibly the author of the article referred to.

I am, Sir,
Your very obedient servant,
CHARLES ATHERTON.

DECIMAL SYSTEM—WEIGHT OF COINS.

SIR,—Whatever system of decimal coinage, if any, be resolved on by the Government, it would perhaps be advisable to regulate the weight of new coins according to the French metrical system. Thus a sovereign might be made, by alloy or otherwise, to weigh 8 *grammes*, instead as of as at present 7.983 *grammes* (= 123.274 grains). Also the silver coinage might be rated at 16s. 8d. the 100 *grammes*, and the copper at 50 pence the *kilogramme*. The *gramme* would accordingly become the element of a new weight, which might be termed, for distinction, "money weight," by which all commodities for Government use, at least, should be purchased. This would quickly prepare the way for an international system.

Your obedient servant,
S. A. GOOD.

H.M. Dockyard, Pembroke Dock,
May 13, 1856.

Proceedings of Institutions.

BARNET.—The season at the Institute was brought to a close on Wednesday, April 30th, 1856, with a musical and literary *soiree*, which attracted an unusually large attendance. A very tolerable collection of works of art, consisting of sculpture, painting, a model of Barnet church, some Indian and African curiosities, old coins (including some specimens of *coal* money), were exhibited, kindly lent for the occasion by Mr. Thimbleby, Capt. Bowie, Sergt. Taylor, Mr. Greenhill, and other friends. The musical performance included the overtures to *Semiramide* and *La Nozzi*. In the hall there was a brilliant display of exotic plants, supplied from the establishment of Mr. William Cutbush. In the course of the evening, the meeting was addressed by Mr. W. Sumpster, Mr. Burch, and the president, Mr. Thimbleby. Votes of thanks were afterwards passed to those who had lent articles for exhibition, or had assisted in the musical performance. During the past season the following lectures have been delivered:—"Why am I?" and "The Lake Poets," by Mr. E. W. Cox; "The Chemistry of War," by Mr. T. A. Smith; "Old Sailors," by Mr. Henderson; "Scraps," by Mr. Hyam; "A Ten Days' Visit to France," "Ennobled Characters," Mysteries of Money," "A Reading from Macaulay's History of England," by Mr. Thimbleby; "English Music and English Musicians," by Miss B. Williams and Messrs. Williams; "The Beauties of Nature," "Life and Times of Mary, Queen of Scots," by Mr. Sumpster; "Nineveh," "The Deluge," by Mr. D. Burnett; Concert, by the Band of the Middlesex Rifles; "Poland," by Mr. W. Wyke Smith (two); "Atmospheric Air," "A Night with Samuel Lover," by Mr. Homerton (who also read Mr. Wilson's paper, delivered at the Society of Arts, "On the Manufactures of Price's Patent Candle Company"); "Monastic Institutions," by Mr. Wilbraham Taylor; "Poetry," by Mr. W. Baldock, sen. (two); "Electricity," by Mr. H. Thimbleby; "Curiosities of Animal Life," Mr. Burch.

BRIGHTON.—The Fifth Annual Report of the Mechanics' Institute congratulates the members upon the present prosperous state of the Institution, the number of its members having more than doubled during the year. At the commencement of the year, there were only 392 *bona fide* members; whereas now there are 871, nearly 200 of whom are females. The funds are in a most flourishing condition, and the enforcement of fines for non-return of books borrowed from the library has been an additional source of revenue to the Institution. The Fête and Soirée have been another source of revenue. The Report then refers to the good feeling existing between the different Institutions in the town, which the Committee trust may long continue. The library, it is stated, now contains 3,057 works of a standard and readable character. The increase of books during the past year has amounted to 361 volumes, 114 by purchase, the remaining 247 by donations, including a donation of fifty-six readable volumes from the oldest Vice-President, Cordy Burrows, Esq. Though works of fiction are in the greatest demand, the Committee state that books of a superior character are read in a much higher proportion than in many other Institutions. The Reading Room has been well attended during the year, and the entertainments given in it by the Mechanics' Institution Band, the Brighton Vocal Union, and the Elocution Class, gave general satisfaction. The classes of the Institution have this year put forth more intellectual strength than they have before assumed. These include the elocution class, conducted by the Rev. A. J. Ross, to which Lady Noel Byron has given a donation of £5, to be awarded in books as prizes to four of its members, who, upon examination, were considered the most proficient. Lady Noel Byron also placed a room at the disposal of Mr. Ross for the use of the class. There is likewise a discussion class; and a class on the "Study of the Human Frame," conducted by Dr. King. The classes on English Grammar, the Rudiments of Latin, Arithmetic, and Writing, conducted by J. Andrews, and T. W. Wonfor, Esqrs., and Mr. Austin, have latterly fallen off. The Committee express regret at the breaking up of the Mechanics' Institution Band. They then refer to the certificates of ability to be granted by the Society of Arts. During the past year twenty-eight lectures and musical entertainments were provided, fourteen of which were delivered gratuitously, including a Reading of Shakspeare's "King Henry V.," by Mrs. Fanny Kemble, to whom the thanks of the Institution were considered as being specially due, as also to Dr. Latham, Professor Creasy, the Rev. J. Griffith, M.A., Rev. A. J. Ross, Lieut.-Colonel Fawcett, Barclay Phillips, Kerrison Sala, F. Merrifield, Cordy Burrows, Montague L. Phillips, T. W. Wonfor, M. Penley, and P. O'Brien, Esqrs., Herr Kuhe; Mr. Kirchner, Messrs. Gates, Zirom, Jewell, W. and R. Devin, and Affleck; the Pavilion, Militia, and Railway Bands; and to the Misses Brougham, for their gratuitous services at the Soirée. From the Treasurer's Report, it appears that the receipts during the year amounted to £326 15s. 8½d., the expenditure to £292 8s. 5½d., leaving a balance in hand of £34 7s. 3d.

HASTINGS.—The quarterly meeting of the members of the Mechanics' Institution was held on Wednesday evening, May 7th, Mr. W. Ransom in the chair. The Secretary (Mr. Banks) read the report, from which it appears that at this period last year, the number of members was 374; during the year, 130 have joined the Institution, 150 have left, so that the number now stands 354. During the quarter just closed, 11 have been elected, and 28 have left. Considerable additions have been made to the library, but not to the extent the committee could wish. The following lectures were delivered during the session:—Mr. Wheeler, "Philosophy of Heat and Cold;" Mr. John Banks, "Nitrogen Gas, and the Non-Metallic Elements;" Mr. C. J. Womersley, "Literary History of the Bible, and the Plurality of Worlds;" Mr. Elliott, "Music;" Mr. Caviler, "The Alhambra;" Mr. Hidolph, "The Connexion between the Animal and Vegetable Kingdoms;" Rev. Mr. Stewart, "Fifty Years Ago;" Dr. Turner, "The Philosophy of the Eye;" Mr. A. Ransom, "Chaucer and his Times;" Mr. James Rock, jun., Carriages;" T. P. Langham, Esq., "On Sound" (two "ectures); T. H. Cole, Esq., M.A., "Sardinia;" J. G. Dodson, Esq., "The Ottoman Empire;" Mrs. Balfour, 'The Seasons and their Relations;" F. North, Esq., M.P., "The Wars of History, and their Effects upon Society;" Mr. W. R. Selway, "Insects in Relation to Man;" Mr. J. Bennett, "A Watch: how to make it, &c.;" Mr. Butler, "Pneumatics;" Mr. Pitter, "Aerial Locomotion." The lectures were all gratuitous, except Mr. Wheeler's and Mrs. Balfour's. Three were given on the payment of the expenses of the lecturer, so that 17 were without any expense to the Institution beyond the hire of the room. The sum of £10 13s. has been taken for the admission of non-members to the lectures. With reference to the Society of Arts examination, a sub-committee has been appointed, whose especial duty it will be to regulate the class department, so as best to secure the proper and efficient working thereof. The Treasurer's account showed receipts for subscriptions from members during the year, £134 5s. 6d.; lectures, £10 13s.; sundries, £5 9s. 11d. Payment for newspapers, £23 12s. 4d.; books and periodicals, £19 3s. 10d.; for lectures, £46 2s. 8d.; rent, £18; librarian, £22 13s. 8d.; gas for two years, £20 9s.; collector, £6 17s.; printing and sundries, £25 10s. 3d.; and a balance in hand of £9 15s. 11d. This being the annual meeting, as well as a quarterly one, the election of officers took place. The result was as follows:—*President*—G. Scrivens, Esq., re-elected; *Vice-Presidents*—F. North, Esq., M.P., Rev. J. Stent, and Messrs. Womersley, Chamberlin, Rock, and W. Ransom, re-elected; *Treasurer*—Mr. J. Hallaway, re-elected; *Secretary*—Mr. J. Banks, re-elected; *Committee*—Messrs. C. Goddard, T. H. Cole, T. S. Hide, J. Purfield, T. Edwards, William Hallaway, William Harman, Ashby, C. Duke, jun., and J. H. Braye. Mr. Banks then read a report from the Museum Committee, in which several donations of money and specimens in natural history were acknowledged. Thanks were then given to the lecturers of the session just over, and to the officers of the past year.

Lynn.—The annual general meeting of the Conversazione and Society of Arts, was held in the lecture-room of the Athenæum on Friday evening, the 25th of April. During the last session the Society has been unusually active in its operations, but these efforts have not been appreciated by those whose advantage it was desired especially to promote. The average attendance at the fortnightly meetings has not been so large as the voluntary efforts of the lecturers deserved. By the financial statement it appeared that a considerable outlay had been made above the income, but not to such an extent as to affect materially the operations of the Society during the next session. If the number of members be slightly increased, the balance-sheet of next year will, it is hoped, show a very different position. The following gentlemen were elected as the officers of the Society for the next session:—Mr. H. Wells, president; Lord Stanley and Mr. H. Edwards, representatives to the London Society of Arts; Mr. H. Edwards and Mr. J. G. Wigg, representatives in the Athenæum council; Mr. Robinson Cruso, treasurer; Revs. T. B. Scott, A. McDonald; Messrs. W. Taylor, J. W. Aitkin, F. Kendle, R. Cruso, jun., W. B. Whall, P. Wilson, W. M. Lupton, W. Cooper, J. G. Wigg, and D. C. Burlingham, the committee; Mr. E. L. King, honorary secretary.

Morpeth.—The exhibition of works of art, and of other objects of interest, in connection with the Mechanics' Institution, which was opened on the 24th of March, has been brought to a conclusion. It is believed that when the accounts are closed, there will be a balance of £12 or £14 in favour of the Institution. The desire of the public to view the articles displayed in the rooms, and to be present at the lectures that were delivered, appeared to increase from the first. The number of members present on the Wednesday evenings, on which concerts were given, was great beyond precedent, and many had to go away, unable to procure admission. Lectures were given by Geo. Brumell, Esq., the Hon. and Rev. F. R. Grey, E. W. Challoner, Esq., the Rev. R. T. Rundle, the Rev. Wm. Ayre, the Rev. S. B. Maughan, the Rev. Henry Hopwood, the Rev. E. J. Maskery, the Rev. J. C. Norman, the Rev. C. T. Whitley, the Rev. James Anderson, and Dr. Donkin. The concerts were given by the Morpeth Philharmonic Band, conducted by Mr. Whinham, and by the choir of St. James's church, led by Mr. John Bates, assisted by a portion of the choir of St. Robert's. The committee of management have much reason to be satisfied with the result of their labours, and great cause to be grateful to many families in the town, and to the gentry of the surrounding district, for the ready and generous manner in which they came forward in contributing interesting objects for the use of the exhibition.

Newport (Monmouthshire).—The fifteenth annual report of the Athenæum and Mechanics' Institute commences by stating that the liabilities at the commencement of last year amounted to £96 2s. 2d. As it was considered that the ordinary receipts of the Institute would never be sufficient to remove this debt, it was thought desirable to make a special effort for the purpose. Accordingly, a public *soirée* was held with very satisfactory results. Tea was provided on the occasion, and during the evening addresses were given on behalf of the interests of the Society, interspersed with vocal and instrumental music. Trays were given, or an equivalent in money, amounting to £15, and during the evening a subscription was set on foot, and about £54 was promised, nearly all of which has been collected, making, with the proceeds from the *soirée*, a sum of £65. The proposed new building has been abandoned, as not more than ten subscriptions have been promised. There have been added (with bound periodicals) 34 volumes to the library, which now contains 2,171 volumes. The number of books circulated during the past year has been 8,685. The lectures delivered during the session were:—"Some Passages of Russian History," by Mr. G. Dawson; "The Life and Writings of Thomas Campbell," by Mr. J. Harrison; "An Illustrative and Impersonal Entertainment, in two parts," by Mr. W. Rowton; "On Character," by Mr. Christophers; "The Combination of the Sublime and Ridiculous," by Mr. A. Bunn; "The Lake Poets," by the Rev. W. Aitcheson; "Martin Chuzzlewit," by Mr. G. Grossmith; "On Self-culture," by Sir Thos. Phillips. The expenditure during the year amounted to £241 2s. 10d.; the receipts to £241 6s. 5½d.; leaving a balance in hand of 3s. 7½d.

Plymouth.—At a meeting of the members of the Institution, on the 6th March last, Mr. J. N. Hearder, mechanician, of Plymouth, delivered a lecture "On the Induction Coil," illustrated by one of his own construction. The lecturer commenced by an explanation of some of the elementary phenomena involved in the action of the apparatus, and elucidated by experiment the discoveries of Oersted, Sturgeon, Faraday, and others, so far as they showed the gradual development of the science of electro-magnetism. The lecturer stated, that having been engaged for many years in the construction of magneto-electric machines, he had often been struck with the power obtained in the secondary coil, though there were no pretensions to insulation in it, beyond the ordinary inferior conducting character of cotton and mahogany. And remarking that even under these disadvantages he frequently obtained continuous streams of static sparks from the secondary terminals, he had often promised himself to construct an apparatus with a perfectly insulated secondary coil, but want of leisure prevented him from carrying out his intention. As soon, however, as he heard of the effects produced by Ruhmkorff's coil, without waiting for a description of it, he proceeded to construct one on his own plan, and with what success the Society would judge for themselves. Since his instrument was constructed, he had had an opportunity of witnessing the effects of one of Ruhmkorff's machines, and it was gratifying to him to discover that his first attempt had, he believed, surpassed what had been achieved on the continent. The instrument before the Society was about half the size of Ruhmkorff's, and, from what he could learn, contained only one-third the quantity of secondary wire. Several of his arrangements differed from those of Ruhmkorff's, but the machine, although smaller, was more powerful. The lecturer then excited the machine with ten Maynooth cells, and exhibited the usual experiments of burning paper, wire, turpentine, and other inflammable substances. The spark between the terminals was more than 0.6 of an inch in length, and was not shortened when a Leyden jar containing two square feet of surface was interposed, which discharged, with thick dense sparks, at the rate of 800 to 400 discharges per second. On passing this current with an iron chain 30 feet long, it appeared like an immense garland of fire, the lateral scintillations from the links being nearly six inches in length, thus making the chain appear as if it were in a state of vivid combustion, ready to fuse and fall upon the floor of the hall. On passing the discharge through a very large lump of sugar, the light was so vivid that the apparatus on the table was illuminated by it. Straight, dense, red sparks, of nearly two feet in length, were produced in an exhausted receiver, and Gassiot's cascade over the edge of a large glass vase streamed out with great brilliancy. After stating his views with regard to the action of the condenser, which in his instrument was rather peculiarly constructed, and could be readily detached from the coil, he described some arrangements for comparing the induction coil with the ordinary electrical machine, and concluded by stating his belief, that secondary currents had very little to do with primary ones, but were the result of the middle agent, viz., the magnetism. In the construction of his instrument, he had been guided by the conviction that the secondary current depended upon the magnetic intensity of the iron core, no matter how that intensity was produced, and he believed that his success had resulted from his having kept that principle in view.

Royston.—On Whit-Monday, an exhibition, in aid of the building fund, was opened in the new hall of the Institute. Nearly a thousand articles are enumerated in the catalogue, and these include a great number of exceedingly rare and beautiful samples of natural and artificial productions. The Fine Arts are well represented by pre-Raphaelite pictures, contributed by Mr. Ruskins—by some fine paintings, pieces of Scripture, and bronzes, from the Earl of Hardwicke's collection—and many other examples in oil and water colours, including a very interesting sketch by H. C. Brown. There are also a fine collection of photographs, chromo-lithographs, and nature-prints, antiquities—oriental manuscripts and manufactures—collections of porcelain—and numerous other examples of the efforts of human industry, which give a most instructive character to this exhibition. On Tuesday evening, Robert Hunt, Esq., F.R.S., lectured on the exhibition. During the lecture he described Paul Pretsch's new process of Photogalvanography, and exhibited some of the most recent and perfect of the prints produced at his establishment. The proceeds already amount to nearly £100. Efforts are being made to form a museum of local productions. Chalk fossils, the flora of Royston Heath, and antiquities found near Royston, are already collected.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 7th May, 1856.

Par. No.
164. Prisons, &c., Schools—Abstract of Return.
122. Bills—Reformatory and Industrial Schools (amended).
123. Bills—Drainage (Ireland).
124. Bills—Fire Insurances (amended).
125. Bills—Justices of the Peace Qualification (amended).
127. Bills—Industrial and Provident Societies.
128. Bills—Transfer of Works (Ireland).
129. Bills—Pawnbrokers.
Public General Acts—Cap. 17, 18, and 19.

Delivered on 8th May, 1856.

159. Election Auditors—Return.
197. Navy Estimates, &c. (Original and Revised Amounts)—Statement.
The Netherlands—Convention.

Delivered on 9th May, 1856.

186. Rural Police—Return.
190. Silver and Gold Wares—Report from the Committee.

To Correspondents.

Errata.—In last number, page 413, in list of members elected, for "Niblet," read "Niblett;" and page 420, col. 2, line 12, for "it was stated," read "he stated;" and lines 17 and 18, for "Professor Hosk*yns*, the official referee of the insurance companies," read "Professor Hos*king*, the official referee."

MEETINGS FOR THE ENSUING WEEK.

Mon. Architects, 8, Mr. John Clayton, "On the Bridges and Viaducts of the Present Day."
Chemical, 8, 1, Messrs. Goessman and Atkinson, "On Lophine;" 2, Mr. J. A. Wanklyn, "On Cadmium-Ethyl."
Statistical, 8, 1, Mr. F. Hendriks, "On the Loss sustained by Government in granting Annuities;" 2, Dr. Samuel Fenwick, "On the Effects of Overcrowding and Want of Ventilation on Cholera."
Tues. Pharmaceutical, 12 noon, Anniversary.
Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Civil Engineers, 8.
Pathological, 8.
Wed. London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. T. Winkworth, "On the British Silk Manufacture, its Condition and Prospects, as compared with that of other Countries."
Geological, 8, Mr. Charles Babbage, "On the Influence of Ocean Currents on the Formation of Strata."
Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.
Fri. Philological, 8, Anniversary.
Royal Inst., 8½, Mr. F. A. Abel, "On some of the Applications of Chemistry to Military Purposes."
Sat. Linnæan, 1, Anniversary.
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May 9th*, 1856.]

Dated 17th January, 1856.

131. John Platt and John Whitaker, Oldham—Improvements in machinery or apparatus for doubling or twining yarns or threads, parts of which improvements are also applicable to mules for spinning.

Dated 15th April, 1856.

895. Hugo Frederick Forbes, Park-place, Regent's-park—Improvements in breech-loading fire-arms and ordnance, and in projectiles used therewith.
897. William Smith, Aston, near Birmingham—Improvements in the manufacture of steel wire for musical and other purposes.
899. Edmund Richard Southby, Bulford, Amesbury, Wilts—Improvement in coating iron with copper.
901. Joseph Demain, Markington, York—Improvement in connecting railway carriages.

Dated 16th April, 1856.

903. William Routledge, Salford—Improvements in the construction of steam engine and other boilers to prevent explosions.
905. Frederick Priestley, Cleveland-street, Fitzroy-square—Improvements in piano-fortes.
907. Thomas Mellodew and John Duxbury, Oldham—Improvements in shuttles for weaving.
909. William Edward Newton, 66, Chancery-lane—Improved apparatus for raising sunken vessels and increasing the buoyancy of floating vessels. (A communication.)
911. William Armitage and Henry Lea, Farnley Iron Works, near Leeds—Improvement in the manufacture of iron.
913. William Wilkinson. Hull—Improvements in steam-engines.

Dated 17th April, 1856.

915. Henry Young Darracott Scott, Capt., R.E., Brompton Barracks, Chatham—Improved mode of manufacturing cement.
917. Lianna Mesure, Billericay, Essex—Improvement in watches.
919. John Luntley, Broad-street—A new fabric or new fabrics suitable for wearing apparel and other purposes to which textile fabrics are applicable.

Dated 18th April, 1856.

921. George Lurig, Adelebsen, Hanover—Improvements in the process of manufacturing saltpetre.

923. William Tytherleigh, Birmingham—Improved method of coating or covering iron or articles of iron with copper or alloys of copper.

925. William Budden, Ipswich—Improved method of preparing cheques, invoices, and other papers, so that they may be readily separated from their counterparts.

927. Thomas Hollingworth, Turkey Mill, near Maidstone—Improved machinery for dusting or cleaning rags.

929. Edward Vincent Gardner, 24, Norfolk-street, Middlesex Hospital—Improvements in furnaces.

931. George Thompson, Marchmont-street, Russell-square—Improvements in instruments or apparatus used in drawing or marking with crayon, "black-lead," or other such materials.

933. Peter William Barlow, Great George-street, Westminster—Improvement in seasoning timber.

Dated 19*th April*, 1856.

935. Claude Moret, 39, Rue de l'Echiquier, Paris—Improvements in rotary steam engines.

937. Thomas Blackburn, Brighouse—Improvements in preparing for spinning cotton waste and silk waste.

939. Charles Frederick Stansbury, 67, Gracechurch-street—A new instrument for determining the position and bearing of ships at sea. (A communication.)

941. Thomas Wilkes, Birmingham—Improved method of manufacturing tubes of copper and alloys of copper.

943. Robert Hazard, 1, Thanet-place, Strand—A heat extractor for extracting the heat from the smoke or heated gases in its passage from boilers, stoves, or furnaces to the chimney, and rendering the economized heat available for drying and warming purposes.

Dated 21*st April*, 1856.

947. Patrick Heyns, Poplar—Improvements in railway wheels.

949. Samuel Mellor, Salford, and Thomas Young, Manchester—Improvements in machinery for supplying water to steam boilers.

951. William Owen, Lincoln's-inn-fields—Improvements in the modes of attaching buttons to wearing apparel.

953. William Maugham, Ifield-terrace, Stockwell—Improvement in the preparation or manufacture of starch.

Dated 22*nd April*, 1856.

955. William James Cantelo, Southwark—Improvements in the preservation of vegetable matters.

957. Alexander Symons, George-street, Mansion-house, and Edward Burgess, Clerkenwell-green—Improvements in instruments for ascertaining and indicating heat, and also in the parts for making and breaking contact in electric circuits used therewith.

959. Augustin Simeon Vimont, Vire (Calvados) France—A new system of machine for spinning wool and any other fibrous material.

961. Peter Brown and George Brown, Liverpool—Improved apparatus applicable to furnaces, fire-grates, fire-places, or stoves, for the purpose of economizing fuel and heat.

963. Christopher Nickels, Albany-road, Camberwell, and James Hobson, Leicester—Improvement in machinery for weaving carpets and terry fabrics.

965. Thomas Jeacock, 20, Bridge-street, Leicester—Improvement in knitting machinery.

967. William George Armstrong, Newcastle-upon-Tyne—Improvements in apparatus for lifting, lowering, and hauling.

Dated 23*rd April*, 1856.

971. Adam Bullough, Blackburn—Improvements in looms.

973. William Peacock Savage, Roxham—A machine for drilling and rolling land.

975. John Shae Perring, Radcliffe—Improvements in chairs for railways.

977. James Barbour, Glasgow—Improvements in sawing apparatus.

979. David Brown, Smethwick—Improved method of joining the rails of railways.

Dated 24*th April*, 1856.

981. Abel Désiré Schratz, Saint Denis, near Paris—Improvements in preparing colours for the impression of woven or textile fabrics or stuffs of any kind.

982. John Yeomanson and William Yeomanson, Leicester—Improvements in the manufacture of knitted fabrics.

983. Thomas Woodcock and John Killingworth Punshon, 26, Great Ormond-street—A machine for cutting and slicing bread and other substances.

984. George Ashworth, Sunny Bank Mills, Rochdale—Improvements in machinery for preparing slivers or slubbings of wool and other fibrous materials, commonly called condensing carding engines.

985. Charles Cowper, 20, Southampton-buildings, Chancery-lane—A new yarn or thread, and its application in the manufacture of stockings, gloves, and looped and other fabrics. (A communication.)

986. Fennell Allman and Donald Bethune, Cambridge-terrace, Hyde-park—Improvements in apparatus for the production of steam, and in the apparatus employed in its application to motive purposes.

987. Victor Doat, Albi, France—Improved galvanic battery and method of recovering and revivifying the agents employed.

988. Walter Neilson, Glasgow—Improvements in locomotive engines.

989. Frank William Blacket, West Smithfield—Improvement in the construction of keys and locks, and in the fitting of locks, to afford increased safety.

990. Thomas Moore, Retford—Improvements in machinery for riddling and winnowing or cleaning corn and other grain.

Dated 25*th April*, 1856.

991. William Naar, Glasgow—Improvements in folding or adjustable articles of furniture.

993. John Hardacre, Manchester—Improvements in the arrangement and construction of carriages and carriage wheels.

994. Charles Swift and John James Derham, Blackburn—Improvements in steam engines.

995. Isaac Daniel Fraétaniel, Paris—Improved safety rein or bridle.

996. William Gossage, Widness, Lancaster—Improvements in the manufacture of sulphuric acid.

Dated 26*th April*, 1856.

998. Thomas Hill, Heywood, Lancaster—Improvements in steam boilers and furnaces connected therewith.

1000. Edmund Topham, Mansfield-road, Nottingham—Apparatus for cleansing out the sediment from the water in steam boilers and preventing incrustation of the same.

1002. William Edward Newton, 66, Chancery-lane—Improved machinery for manufacturing painted or enamelled cloth. (A communication.)

1004. Thomas Walker, Warwick-place, Pimlico—Improvements in playing cards.

1006. Thomas Heiffor, Sheffield—Improved method of manufacturing razor blades.

Dated 28*th April*, 1856.

1008. Jean Charles Bertrand Dubos, Paris—Improved electro-magnetic apparatus.

1010. Henry Geering, Birmingham—Improvements in metallic bedsteads, chairs, couches, and other articles for sitting, lying, or reclining upon.

Dated 29*th April*, 1856.

1012. Charles Joseph Graftiaux, Molenbeck St. Jean by Brussels—Improvements in rotary steam engines.

1014. James Stead Crosland, Openshaw, near Manchester—Improvements in furnaces and steam generators for locomotive steam engines and other purposes.

1016. Charles Titterton, Roehampton—Improvement in the manufacture of white zinc.

1018. Isaac Abraham Boss, Bury-street, City—Improvements in preparing cane, in order to render it suitable to be used as a substitute for whalebone. (A communication.)

1020. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in anchors. (A communication.)

Dated 30*th April*, 1856.

1022. Francis Gybbon Spilsbury, Chaudfontaine, Belgium, and 56, Stones-end, Borough—Separating metals, metallic oxides, and metallic acids from their ores.

1024. Joseph Rigby, Ashton-under-Lyne—Improvements in machinery for grinding or sharpening the card cylinders and rollers of carding engines.

1026. Wright Jones, Pendleton—Improvements in apparatus for regulating the pressure and flow of steam, water, and other purposes.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 9*th*, 1856.

2551. Fischer Alexander Wilson.
2560. Henry Laxton.
2561. James Burrows.
2575. Franz Duncker.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

May 6*th*.

1135. John Fisher.
1157. Samuel Cunliffe Lister.

May 7*th*.

1232. William Gossage.
1287. William Haslett Mitchel.

May 8*th*.

1136. David Law.
1140. Thomas Quaife.
1144. Thomas Murray.
1190. George FitzJames Russell.

May 9*th*.

1143. John Clapham, Thomas Clapham, and William Clapham.
1194. Thomas Stephen Holt.
1196. Herman Dirs Mertens.

May 10*th*.

1167. Edmund Whitaker and James Walmsley, jun.
1175. Joseph Denton.
1203. John Drumgoole Brady.
1204. Robert Walter Swinburne.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3835	May 8.	Brass-bound Square or Bevel	Silverwood and Marsh	Sheffield.
3836	May 9.	E. Wood's Ever-Pointed Receding Pencil.	Ebenezer Wood	6, Felix-street, Liverpool-road, Islington.

Journal of the Society of Arts.

FRIDAY, MAY 23, 1856.

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ANNUAL CONFERENCE AND DINNER.

The Annual Conference of the Representatives from Institutions in Union with the Society is appointed to be held at the Society's house, on Monday, the 23rd of June.

The Annual Dinner will take place at the Crystal Palace, on Tuesday, the 24th of June.

Further particulars will be announced in an early number of the *Journal.*

OFFICE OF ASSISTANT-SECRETARY.

The office of Assistant-Secretary of the Society of Arts will be vacant at the end of June, its present holder, Mr. James Forrest, having been appointed to the Institution of Civil Engineers. The Council have resolved that the office shall be thrown open to competitive examination. The particulars will be announced without delay in the *Journal.*

HONORARY LOCAL SECRETARIES.

The Council have resolved to appoint Honorary Local Secretaries of the Society of Arts in the several provincial cities and large towns of the United Kingdom. The Society of Arts has long felt the need of authentic sources of local information and the want of provincial co-operation.

The approbation with which its measures have been generally received, proves that the sympathies of the country, when elicited and tested, are with it. But sympathy is not enough,—active co-operation is required. There are besides many subjects of national and local importance on which accurate information in abundance exists, but it cannot be turned to general account because not generally known.

To multiply the centres of the Society's operations, and to direct the energies of many who are prepared zealously to aid the Society, if they could but see the way to do so, the Council propose to invite gentlemen of standing and of influence in their respective neighbourhoods to undertake the office of Honorary Local Secretary of the Society of Arts. They will receive the Society's *Journal* and other published documents from time to time; and the facilities of an office for receiving and forwarding letters, books, &c., will be afforded them at the Society's House in the Adelphi. The Honorary Local Secretaries will be expected to advise the Council on such matters as may be submitted to them, and to afford generally their aid in promoting the objects of the Society. They will go out of office annually, with the Council and Officers, but may be re-appointed after the annual election of the Council of the Society. Their names will be published with those of the President, the Vice-Presidents, the Council, and the Officers of the Society.

Honorary Local Secretaries elected by the Council on the 21st May, 1856.

William Sands Cox, Esq., F.R.S., for Birmingham.

John Waterhouse, Esq., F.R.S., for Halifax.

Henry Newall, Esq., for Rochdale.

THE BRUSSELS ECONOMIC EXHIBITION.

The Committee appointed by the Council of the Society of Arts in aid of the Economic Exhibition to be opened at Brussels on the 25th of August next, has received very favourable communications from the Belgium Commissioners. Promises of contributions have been sent in from Germany, Switzerland, France, and Holland, and the Commission being particularly desirous of securing the co-operation of British manufacturers in this undertaking, has used every endeavour to render it deserving of their support, both in a commercial and in a benevolent point of view. This Exhibition is to be held in connection with an International Congress, for promoting health and comfort among the poor; it is intended to form the ground work of a permanent economic museum, and it will comprise specimens or illustrations of articles or contrivances which may enable the working classes to improve their condition as to their dwellings, furniture, and household utensils, their food and clothing, their industrial pursuits and their intellectual development. As the Exhibition will be visited by a number of individuals from various countries, and the catalogue will be widely circulated, this will amount to an extensive advertisement in favour of the exhibitor. The Belgian government has agreed to deduct 50 per cent. from the usual railway charges, and the Exhibition Commission will bear all charges in Brussels—such as cartage, stalling and exhibiting the goods.

Should the exhibitor desire to sell his articles, the Commission offers assistance for that purpose.

Contributions may be consigned to Messrs. Mertens Krupel and Co., 8, Catherine-court, Seething-lane, London, the agents for the Belgian Commission. If the articles are to be returned to England at the close of the exhibition in October, the expense of conveyance to and from Brussels will be borne by the contributors; the charge from London to Brussels will be at the rate of one shilling per cubic foot. The same will be charged for the return of goods from Brussels.

If the articles are presented as donations to the Belgian Government for being exhibited permanently in the proposed museum, the contributor will incur no trouble or expense beyond consigning his contributions to Mertens Krupel and Co.

No customs duties will be charged unless the articles are sold in Belgium.

A detailed programme of the Exhibition has been translated into English, and may be had on application to the Secretary of the Society of Arts.

EXTRA-ORDINARY MEETING.

FRIDAY, MAY 16, 1856.

An Extra-Ordinary Meeting was held on the evening of Friday, the 16th inst., for the purpose of resuming the discussion upon Mr. Braidwood's paper on "Fires; the Best Means of Preventing and Arresting them, with a few words on Fire-proof Structures." John Thwaites, Esq., Chairman of the Metropolitan Board of Works, presided, as on the former occasion.

The Secretary asked permission to read to the meeting several communications which he had received, having reference to the subject under discussion. These were

FIREPROOF, NON-COMBUSTIBLE, AND FIRE-EXTINGUISHING BUILDINGS.

By W. BRIDGES ADAMS.

The building of cities might be, but is not, a philosophical process. They have usually grown out of accidental circumstances united with peculiar localities, not having reference to all the wants of man. The general requirements in a city are—good drainage, either natural or artificial; well-formed and paved streets, with the minimum of dirt, and the greatest facility for walking and traction; complete ventilation, only to be attained by the streets being all thoroughfares, and the width of the streets being at least twice the height of the houses; convenient arrangements for warmth indoors; and absolute incombustibility in the buildings.

Walls are made perfectly incombustible of brick and mortar, but they are not incapable of destruction by the agency of burning materials, because, by the action of fire the mortar returns to its original condition of quick-lime. To be perfect, they ought to be of fire-stone or brick, cemented with fire-clay.

Floors may be made of groined brick arches, resting on brick pillars, but, to be indestructible by fire, they also should be built without lime mortar.

But such floors and supports would be a great waste of space; therefore, flat floors are required, either spanning from wall to wall, or supported at intervals by pillars of small size.

The only material of which flat floors can be constructed is, beams of iron, and wrought iron in preference, as being many times stronger with equal bulk.

But inasmuch as iron is capable of being damaged by the combustion of burning material in contact with it, it becomes necessary to surround it with non-combustible material, capable of withstanding great heat.

The floors known as Fox and Barrett's are constructed of wrought iron beams covered in with concrete. The thickness of the concrete is very important; but as lime enters into the composition, continuous heat of sufficient intensity would gradually destroy the iron.

Fire brick and clay in sufficient masses would render such a floor indestructible by fire.

The only objection to such floors is their great weight.

Where no mass of combustible material exists in the building, floors of sawn slate may be applied; the joints being caulked with elastic material. The roofs might be constructed flat on a similar principle, with great economy in structure, and with the advantage of adding another floor gratuitously, either as an open terrace, or to support a greenhouse. Between the ceiling and the slate roof air might circulate in warm weather, and be a fixture in cold weather.

The floors being hollow, would serve for the passage of air for warming and ventilation.

The staircases could be either of sawn slate or of metal bars built into the walls and covered with fire-bricks.

As regards warming, two classes of heat are required—warm summer heat, in the form of flowing air: and radiant heat, for warming the extremities of the body, or for the purposes of cookery. The heat that is healthy for the lungs is insufficient for the feet for those following sedentary employment.

No building can be healthy that is not warm and dry: and the conditions of dryness and warmth are precisely the conditions essential to rapid combustion and the destruction of combustible buildings by fire.

The Houses of Parliament, the Royal Exchange, and other public buildings, were burnt down, because, being combustible, they were unfitted to be warmed by the modern processes of heated air, which dried all the woodwork to a condition of tinder after being some time applied.

It is, therefore, important, even in a sanitary point of view, that all buildings be fireproof, and the same kind of dryness is also important in warehouses.

For the supply of warm air, it would be much better to produce it in a separate building, and supply it by meter to a whole neighbourhood, just as gas is supplied. This will probably be some day accomplished, and the air will be drawn from as great a height as possible, for the sake of purity.

For radiant fires, whether of gas, coal, coke, or other material, chimneys are essential. Chimneys, as ordinarily built, are formed of bricks, the horizontal joints of which are close, while the vertical joints are open, or only closed with a covering of what is called "pargetting," a mixture of mortar and cow-dung. The object of this is to prevent shrinking and cracking. Gradually the cow-dung burns out, the "pargetting" falls down in a crumble, the joints are open and draw air, the chimney smokes, and fire may thus get access to the floors.

To make accurate chimney flues, the interior should be lined with a flattened tube of iron or of pottery; if glazed inside, so much the better. Near the fire the tube should be of fire-clay; and wherever heat penetrates, fire-bricks and fire-clay should be used instead of ordinary bricks and mortar.

We occasionally see original bad chimney constructions eked out by tall zinc chimney-pots. In cold weather, the air is condensed within them, and forms a practical stopper to prevent the smoke from ascending. If these zinc pots were made double, with half an inch of air-space between, the result would be a warm chimney, and this class of evil would be amended.

It is obvious that a building thus constructed might be roasted inside with any amount of gas or hot air without sustaining damage. The only fire must arise from the furniture.

It may be objected that the floors would be cold without boarding. But thin wood parquetry, saturated with non-combustible solutions, might be used to cover them. Neither this, nor woollen carpets, nor woollen curtains could aid fire.

Furniture, as chairs, beds, and couches, might all be of elegant iron-work. Table-tops might be of marble, slate, or metal. Linen, books, and other articles, could not be in sufficient quantities to aid combustion.

A building such as described, if built with solid floors, would be fireproof. But an iron building, well constructed, though not fireproof, would be incombustible, and if furnished with incombustible materials, would be very desirable where ground-rents are dear, and space is limited, on account of the extreme thinness practicable with double walls of metal.

It may be remarked that this class of building will answer very well for dwellings, but would be useless for warehouses on account of the mass of combustibles.

Let us consider this question. Warehouse goods consist of explosive materials, rapidly combustible, and slowly combustible. Explosive materials, it is clear, should not be permitted at all in cities, and rapidly combustible materials should either be separated into small quantities, or the building in which they are placed should be isolated by fireproof external walls, from all other buildings. Bales of cotton, cylindrical in shape, and with air spaces between them, are among the most combustible materials, but woven cloth closely folded, books and paper in reams, and similar materials are very difficult of combustion.

There is no doubt that the most convenient form for a warehouse is four external walls, with the floors supported internally on columns, and central wells opening through them from top to bottom; and the larger the warehouse the more economical is the building. But the Building Act prescribes that it shall be divided by party walls into small portions, whatever be the class of goods to be warehoused. And even iron beams and columns are objected to.

The problem to solve is, to make the columns and beams fireproof, and to make the fires that may happen self-extinguishing. If the floors be formed with brick and fire-clay, and the columns be surrounded with the same material, and the brick surrounded with sheet-iron, to prevent wear, that first object will be accomplished. There is no more difficulty in making the building fireproof than in constructing one of Milner's fireproof safes. The central wells should all be fitted with sliding iron trap-doors. The stair-heads should close with wrought-iron doors, the windows with wrought-iron shutters.

Nor is there any great difficulty in so arranging that the fires may help to extinguish themselves. The warm air, which should freely circulate in the day-time, to keep the goods dry, should be cut off at night; and with closed doors and windows, if fire happened, it would probably suffocate itself. But we must also calculate for carelessness, the leaving open doors and shutters, and, therefore, other means must be provided.

On the roof capacious cisterns should be provided, with descending pipes communicating with a series of parallel horizontal pipes, or a network of pipes covering over and attached to each ceiling. From these ceiling pipes, say three inches in diameter, should project downwards, an inch or two apart, a series of fusible tubes hermetically sealed. In case of a fire, the fusible tubes would burn away with the ascending flame, and the water would pour down vertically on the flames and burning goods.

The roof cisterns should be connected with external pipes, communicating with the street mains, under pressure, or with engines, which would thus become force pumps, carrying the water to the extreme height of the building. Thus, provision could be made for pouring water directly into the fire; and combings, like ships' hatches, being provided for the staircase and well, on each floor, with an exit pipe, no damage could be done by water running from the storey on fire to those below it. Only that part would be drowned which it would be desirable to drown. Each floor would be like a huge tray holding a given quantity of water, with a waste-pipe to prevent it from running over.

Now, let us see what objections can be found to such a simple system.

First. That in process of time the pipes might become clogged with sediment. This might be guarded against by having exit cocks on every floor, and running off the water not every night or every week, but say on the first of every month. And as a further security no water should be used in the premises but that passing through the pipes. Daily necessity would thus ensure against neglect.

An illustration. A gentleman residing in the country had his house cisterns supplied with water by a force pump in a well. One cistern supplied the stable and garden; another the house, the groom and gardener having it in charge to fill the house cistern as well as their own. As a result, the house cistern was constantly empty, and the cook and other servants quarrelling with the groom and gardener. The master, after some change of servants and vain exhortations to regular duty on the part of the equine and horticultural representatives, bethought himself of going to the root of the evil. So sending for the plumber, he caused the whole supply to pass first into the house cistern and thence into the stable cistern. Nothing ever went wrong afterwards save in time of frost. Neither groom or gardener could supply themselves till the house had its allowance.

With regard to frost. Water pipes burst. But there is a remedy for this. As a matter of course a very large warehouse has a watchman. For his own sake he will take care to have a good fire if he can get one in cold or frosty weather. If his only fire be the furnace fire, used to circulate the water in the pipes, which may serve to warm or partially warm the building, he will take good care to keep that fire going for the sake of his own pleasant sensations, and the constant warning of the pain of cold. This arrangement would certainly make a self-acting watchman, and there does not seem any reason why the apparatus should get out of order.

If cities were built on such a system, it is quite clear that there would very soon be an extinction of Fire Assurance Companies. The existence of risk is an essential principle to induce assurance, and without supposing that shareholders in such companies are worse men than their neighbours, it is evident that the continuance of a profitable business must depend on occasional fires to such an amount as will keep the general mass of building owners in an uneasy condition. Even mutual assurance companies cannot help being pleased with an occasional destruction of property—not involving life—which may bring grist to their mill. It is the very principle of competitive trade.

Fire insurance offices are, in short, either a silent satire on the human ignorance which erects dangerous buildings fitted for burning down, or an indication of poverty of power as regards capital, or poverty of invention, or both.

With regard to cost. If the legislature, deeming it right to guard human health from unwholesome buildings, as well as human life from dangerous buildings, should determine some day that all future buildings must be noncombustible, a great impulse will be given to the production of iron, brick, and stone, natural and artificial, and noncombustible buildings will come to be cheaper than combustible ones. They are, in fact, cheaper at present, if we take into account—insurance—doctor's bills—repairs—and inconveniences of all kinds; saying nothing of the process of being burned in bed, and the concomitant taxes for fire escapes and other patch-work contrivances.

It is quite true that we cannot all at once get rid of our present dangerous buildings, but we can establish a principle, and, to a considerable extent, we can make it self-acting, by promoting the extension of non-combustible iron buildings in those situations where ground is costly, as in the city of London. For example:—Suppose a site 20 feet by 40 feet, and the four walls to be each 18 inches thick in brickwork, twenty per cent. of the area is lost, or about 170 feet out of 800 feet. If the walls be of double iron, and only 6 inches in thickness, the loss in area will be little over 6 per cent., or about 50 feet out of 800 feet, being a saving of 120 feet as compared with brick. If this be multiplied by five stories, we have a saving in space of 600 feet total, or nearly 67 square yards. When we think of the almost fabulous prices of City building sites, and multiply this result of one building by the whole of the buildings in the city, it is practically equivalent to the creation of so much new land—67 square yards on a base area of 89 yards.

This is a question very imperative for the consideration of the Metropolitan Board of Works, and the adoption of such a principle would give rise to new improvements in preserving iron from oxydation, and possibly to some new kind of compound metal, not subject to rust; at any rate, to a cheap and effective process of bituminising, as a substitute for the miserable wash of zinc called galvanising, which gradually disappears in a surface of red rust. The tin-plated roofs of Montreal and Quebec, flashing in the rays of the sun like a silver city of romance, are infinitely preferable to this. Tin is a metal not easily oxydised, and shelters the iron hermetically. Zinc being a metal easily oxydised, shelters the iron only by opposing its own substance to be devoured instead, as a kind of scapegoat. The oxydised zinc then rubs off, exposing a new surface, which is eaten in turn, till finally the iron is left exposed to the full action of the oxygen.

If we examine the various structures exposed to the continual action of fire, we shall find a locomotive boiler fire-box one of the most durable, considering the intensity of the heat. In a case of necessity, for an absolutely fire-proof building, it would be possible to attain it on this principle. With hollow walls, hollow floors, and hollow columns, all communicating and filled with water, supplied by an over-head cistern, the whole building would be water-clad. Consequently, any heat on the surface of the metal would be communicated to the water, and thus pass off without the possibility of the iron getting heated up to burning or melting point. The heat of the fire might thus cause the water to boil over at a certain level and put the fire out.

Examining the whole question of fire risk philosophically, we are constrained to regard fire extinguishers and fire escapes of all kinds, as mere temporary means or expedients to work on with a very imperfect system of building, and that our true policy is to work onwards as fast as we can, towards a perfect building system. We are fast abandoning combustible materials in ships, mainly induced by the greater internal space we can attain with iron, the greater safety from fire being only a contingency. Precisely the same principles hold good in crowded cities with high-priced land.

But as long as combustible buildings shall continue, there can be no question that the steam fire-engine is the best; and, if rightly constructed, the steam can be got up as rapidly as the horsing and water connecting, and other arrangements.

THE FIRE-ANNIHILATOR AS A MEANS FOR SUPPRESSING FIRES.

Office of the Fire-Annihilator Company,
105, Leadenhall-street, London, 13th May, 1856.

SIR,—The paper by Mr. Braidwood, on "Fires: the best means of preventing and arresting them, &c.," read before the Society, on the evening of Wednesday, the 7th inst., and the discussion which followed the reading of the paper, present points of the greatest interest to us, whose attention has been specially directed for several years past to the promotion of an improved means for suppressing fire.

The object of the Society in inviting discussion on the very important subject of Mr. Braidwood's paper, is to draw out facts and opinions for information and record.

We noted two points of great interest in connection with the subject as requiring notice on our part. We conceive that we shall promote the object in view by laying before the Society the observations which those points suggest; and, therefore, submit to you for presentation to the meeting, on Friday evening next, the following communication.

The two points which the paper and the discussion presented to us are—1st. The omission by Mr. Braidwood of any reference to the fire-annihilator or vapour fire-engine. 2nd. The suggestion that the fire offices are not interested in suppressing fires.

1st. The omission by Mr. Braidwood of any reference to the fire-annihilator, is equivalent to an expression of opinion that the fire-annihilators are useless as a means of suppressing fire—such opinion has, in fact, been on several occasions expressed by Mr. Braidwood. The opinion of that gentleman—based on a very large experience—is worth the utmost value which any opinion can carry; but (and we feel assured that the Society will assent to the proposition which we put forward) *no man's opinion is worth a straw in the face of facts.* We will now produce such evidence of facts of use of fire-annihilators, at casual fires, both by firemen and by inmates, as shall satisfy the Society, not only that Mr. Braidwood is without justification for the omission from his paper of all reference to the fire-annihilator, but, further, that he is without justification for neglecting to adopt these improved means for extinguishing fire for the use of his Fire Brigade.

The several cases of use of fire-annihilators, at casual fires in buildings, from April, 1851, to the present date, number 38, ranging from the serious chimney fire to the fire in the uninsurable premises of the Imperial Patent Wadding Company, Manchester.

These cases may be divided into four classes, viz.:—use by Leeds Fire Brigade; use by Gravesend police; use by firemen of Fire-Annihilator Company; use by inmates.

The machines have been in use by the Leeds Fire Brigade since the beginning of the year 1852. A "fire-annihilator" carriage, containing six hand machines, with a large machine on wheels attached, has the first pair of horses, and precedes the fire-engine to the fire. Another large machine, on wheels, is attached to the fire-engine.

In February, 1853, the superintendent of the Leeds Fire Brigade testified as follows:—"From the practical experience I have had, I cannot hesitate to bear my testimony to the utility and value of the fire-annihilators, particularly for the use of a fire brigade in aid of the engine; as by means of these, flame is instantly got under, and the dense smoke absorbed or dissipated, and thereby the efforts of the firemen most materially aided, and premises and stores saved from wasteful damage by water." Mr. Superintendent James has since declared that subsequent experience has confirmed the opinion above quoted.

The following is a short notice of cases of use by the Leeds Fire Brigade:—In three cases, model shop of a machine-maker (two storied building); wing of a flax mill, (three storied building); hemp and flax dressing shop, (large two storied building); the fire is described to have gained head before the arrival of the Brigade—flames ascending to a great height above the buildings. The machines extinguished the flames instantaneously, and brought the fire within manageable compass. In the case of a builder's dry house, connected with a joiner's shop and timber-yard, the flames which had reached a great height were instantly extinguished, "in fact," Mr. James writes "it was similar to putting an extinguisher on a lighted candle." In two cases—a hay and straw store—a private dwelling house—the difficulty was smoke. The machines enabled the firemen to enter the buildings, and trace out and extinguish the fire. In the case of a straw bonnet stove, the effect of the machines was so complete that we will narrate the facts in Mr. James's own words. "A straw bonnet stove is heated by sulphur, consequently at the recent fire, which arose from the overheating of the stove, the fumes were most suffocating, so much so that all my men retired, not being able to bear it, after they had put the machine at the door. I was nearly done myself, but kneeling down and placing my face close to the floor, I managed to raise my arm, and discharge the machine. The moment the vapour began to work out, I pushed opened the door. The sulphur smoke began to rush out, but the vapour from the machine drove it back; I then felt sensible relief, and was able to carry the machine into the room and breathe without any difficulty. I then took in and discharged the second machine, and the fire was instantly suppressed; several people almost immediately entered the room." In the above case great damage was done by water recklessly thrown into the room by the Fire Office engines after the fire had been extinguished. The proprietor complained to the Town Council, who passed a resolution placing the water mains from that time forth under the control of the Fire Brigade Superintendent. In two shop fires, hair-dresser and toy-dealer, woollen and stuff merchants, the superintendent testifies that but for the prompt suppression of the fire by the machines a very great destruction of property would have resulted. In the case of a bookseller's shop, on fire both back and front, two machines discharged, thrust in and left, completely extinguished the fire without the use of a drop of water. In two cases of fire in the same premises—an ironmonger's—the instantaneous suppression of the flames by the machines most probably prevented very disastrous results, as canisters of gunpowder were in both cases found close to the seat of fire.

The Gravesend police have used the machines in three cases—dwelling-house of a coach-builder's, linendraper's shop, and premises of a gingerbeer-maker and fruiterer. In the first case, Mr. Superintendent White and the town surveyor, Mr. Gould, both declare that unless the fire had been so promptly suppressed by the fire-annihilators, nothing could have prevented an immense destruction of property.

The firemen of the Fire Annihilator Company, stationed at Manchester and Liverpool, used machines in four cases; grocer's shop, and upper story of a pawnbroker's at Manchester, and a linendraper's and public bake-house at Liverpool.

The following are the most striking cases of use by inmates—Imperial Patent Wadding Works, Manchester. The fire offices had refused to insure these premises. The manager testifies as follows:—"Owing to the great heat required in the manufacture of our goods, and the consequent liability of the material to ignite, the insurance offices have always refused to insure our premises, even at the rates paid for the most hazardous trades; now, however, we consider ourselves perfectly safe; for, in addition to your apparatus, we have both steam and water conveyed in pipes to all parts of the building, but we consider the annihilator will be able to put out any fire that may hereafter occur. One that took place in January last, was put out in about five minutes by three charges, (although it spread with the rapidity of gunpowder a distance of 150 feet) and the men were enabled to resume work in an hour afterwards. Two other great advantages the annihilator possesses; the vapour enables persons to breathe in the room where the fire is, and the apparatus can be used without causing the least damage to the machinery, as is the case with both steam and water." In two cases, Mr. Hulme's Cotton Waste Mill, Stockport, and Varnish Works of Messrs. Wilkinson, London, the prompt use of the machines no doubt prevented very serious fires. In two cases, buckets of water had been used without effect, but the fire was instantly checked by machines, viz., at the printing house of Messrs. W. and R. Chambers, stack of timber at the Stratford station of the Eastern Counties Railway. In the cases of fire in the drying stove of the floorcloth manufactory of Messrs. Story, Bros., Lancaster (caused by the bursting of the flue), and of fire in the chimney stack at the varnish works of Messrs. Mander, Bros., Wolverhampton (caused by ignition of varnish in process of making), the fire was immediately suppressed by machines. In the case of the cotton-mill of Mr. Riley, Stockport, all efforts to enter the room on fire were baffled by smoke. Machines were used, and the room immediately afterwards entered with ease. Two mills have been saved; the woollen mill of Messrs. Braithwaite and Co., Kendal, Westmoreland, as testified by the following extract from their letter:—"The smoke was so dense that he could not enter the room; and in attempting to do so he nearly lost his life. He then remembered the annihilator, and running to his house (about 300 yards), found his wife had got it ready. On applying it at the entrance of the room, it cleared it so effectually that he could proceed with perfect ease. The vapour from the machine cleared the smoke and turned the red-hot wood and iron perfectly black. The men were enabled to enter the room with buckets of water, and the fire was quenched. . . . . Many intelligent persons, who came the next day to see the room, say they never saw a place saved where the fire had got so great a hold. . . . . We owe our preservation, under Providence, to your machine." The flax-mill of Messrs. Andrews and Co., Calne, Wiltshire, as testified by the following extract from their letter:—"The fire broke out in the third or middle story, in the room called the "Tow-room," while the people were at work. The room was filled with tow, and the whole was in a blaze almost immediately, so that the people were driven out without having time to move the strap from the wheel, and stop the machines. The annihilators were brought up and discharged, one after the other. The effect was like magic, the whole blaze being brought down instantly; some water was then thrown on and the fire extinguished. We have no hesitation in stating our belief that if we had not had the annihilators the whole mill and its contents would have been destroyed, for both the rest of the third floor, as well as the floors above, were full of tow; and if the flames had not been extinguished, as they were by the fire-annihilators, the whole would soon have been in a blaze. The woodwork of the machines, as well as of the room, was much burnt." This mill was insured in the Atlas Office. The fact that the mill was saved by the machines, was admitted to the undersigned by the chairman of the Company.

The several cases shortly recited above are published in *extenso* by the Fire Annihilator Company.

These cases establish the following as the merits of the fire-annihilator:—

1st. The power of instantly extinguishing flame.
2nd. The power of subduing smoke, so that an entry may immediately be made into a place previously inaccessible.
3rd. The ready means of suppression by inmates in cases in which ordinary means are insufficient, and any delay would result in total destruction.
4th. Means in aid of engines for Fire Brigade purposes, bringing the fire immediately into manageable compass, and saving wasteful damage by water.

In the face of the above facts, how can Mr. Braidwood justify the omission from his paper of any reference to the Fire Annihilator?

In the face of the facts of use by the Leeds Fire Brigade and Gravesend police, how can Mr. Braidwood justify his neglect of these means in aid of his water engines?

Mr. Braidwood, in his paper, writes—"The main rule to be observed is to get as near the fire with the branch INSIDE the building as possible, so that *the water may strike the burning materials*. If this cannot be done, the probability is that the building which takes fire will be lost." This is an admission that the water engine is not a complete means for suppressing fire. The practice of the Leeds Fire Brigade has demonstrated the value of the Fire Annihilator as an auxiliary power. The means in aid so successfully used by Mr. Superintendent James, of the Leeds Fire Brigade, can surely be turned to good account in the experienced hands of Mr. Superintendent Braidwood of the London Fire Brigade.

In the face of the facts of use by inmates, how can the Fire Offices justify their neglect of an improved means of suppressing fire at the outbreak? This last query leads to the consideration of the second point, viz.:—

2ndly. The suggestion that the Fire Offices are not interested in suppressing fires. This suggestion requires modification, but, modified, presents a truth. The Fire Offices are deeply interested in the suppression of large fires, but it is not their interest (so they consider) to encourage means for checking fire at the outbreak. The great fire entails heavy losses, but the small fire induces much business. A warehouse fire causes a panic among the offices, but a dwelling-house fire frightens careless people to insure. It is a purely commercial question, and the suggestion noted above must be taken not as an imputation upon the Fire Offices, but simply as the statement of the commercial policy which they consider it to be their interest to pursue.

This question is fully treated in a printed paper, headed, "Reasons why the Fire Offices do not adopt the Fire Annihilator, and why such neglect of an improved means of extinguishing fire is impolitic on the part of the Fire Offices," originally prepared more than a year past for the information of Mr. Masterman, M.P. for the City of London, and a director of the Phœnix Fire Office. This gentleman was so much struck by the observations of a friend who witnessed some experiments with the Fire Annihilator, that he desired to be furnished with information, and expressed his opinion that the Fire Offices were interested in the encouragement of the invention. A conference with his office changed his views. Similar opinions of individual directors of fire offices have undergone, after reference to their offices, similar changes. Individual directors of the Sun, Imperial, Phœnix, and Atlas Fire Offices have purchased fire annihilators for their own protection, but the instrument is ignored by the Sun, Imperial, Phœnix, and Atlas. The fact being as noted above, encouragement of means of check at the outbreak of a fire is considered to be opposed to the commercial interests of the offices, but the view so taken is narrow and impolitic. Encouragement of means of check, and reduction of rates consequent on the lessened risk, would no more work to the injury of the fire offices, than free trade has been found to work to the injury of the farmer.

In conclusion, we beg to adduce the unexpected and remarkable testimony to the practical value of the fire annihilator, given by Mr. Baddeley in his last two Annual Reports, published in the *Mechanics' Magazine*. In the Report of 1855, Mr. Baddeley writes, "Mr. James, Superintendent of the Leeds Fire Brigade, as also Mr. Superintendent White, at Gravesend, have made several very successful applications of the fire-annihilator, showing that when skillfully applied to a legitimate case, the apparatus is not so utterly valueless as it had appeared from the improper uses to which it had been applied, and the exaggerations and misrepresentations by which its pretensions had been supported." In the Report of 1856, Mr. Baddeley writes:—"Another trial of the fire-annihilator took place at Woolwich last year, but, like the former ones at the same place, it proved unsuccessful. It seems to be the singular fate of this invention to fail as an experiment, while it is almost always successful in practice!—a result only to be accounted for upon the supposition that the practical applications are legitimate,—that the experimental trials are not so,—and this is pretty near the truth of the matter."

The above testimony is the more remarkable, as when Mr. Phillips' invention was first brought out it met with no more strenuous opponent than Mr. Baddeley. The opinions quoted are certainly presented in connection with rather adverse matter. We do not think it necessary to enter into an explanation of the occurrences noted or a correction of the misapprehensions put forward. We accept of the valuable testimony as enhanced in value by the depreciatory matter in which it is set. Mr. Baddeley is a convert to facts.

I am, Sir, your very obedient servant,

J. E. B. CURTIS, Secretary.

Lady BENTHAM says, "In justice to the memory of the late Sir Samuel Bentham, I would request you to make known at the adjourned discussion on fire-extinguishing works, that he was the inventor of those so successfully introduced at Hamburgh, Liverpool, and other British towns. His first proposal on the subject was in 1797, when he wrote officially to the Admiralty, and in consequence, these works were erected at Portsmouth, and subsequently at Plymouth; for a description of which I would beg to refer to the 83rd number, Vol. 2, of the *Journal of the Society of Arts*."

Prof. HOSKING, in a note to the Secretary, refers to a little book written by him in 1847, entitled, "Healthy Homes," and to an article in the *Encyclopædia Britannica*, on "Construction," written in 1854, as containing his views on the subject of Mr. Braidwood's paper. In this article a section is devoted to "Security of Buildings from Fire." The following passage explains how, in Mr. Hosking's opinion, dead heat may lead to the combustion of timber in buildings:—

"It is to be understood, at the same time, that a piece of wood will bear a powerful dead heat upon its sides for an indefinite period without igniting, unless a transverse section of the fibre, as at or around a live knot, or where a branch had been lopped, presents itself to the action. It is by the end that a piece of wood, exposed to powerful heat, most readily ignites. The gases evolved in the substance of the timber, by the action of heat applied to its surface, expanding as they are evolved, are thrown out by the pores among the fibres at their ends, if the ends are near enough to the action to allow of this effect, with less power than may be enough to obtain vent for the inflammable gases laterally."

Mr. Hosking adds that, four years ago, he applied much of what he had advocated in respect of security from fire in buildings in a new compartment of Messrs. Clowes' printing office, and that he is now applying the same system, more fully, perhaps, in Messrs. Beren's and Co.'s large stack of buildings in Cannon-street.

Mr. TOLHAUSEN has communicated the following extracts from the *Scientific American*, bearing on the subject under discussion:—

"Mr. E. Konklin, of Cincinnati, suggests the kyanizing of all timber to be used for buildings, so as to render them more fire-proof. He believes that the extra cost of preparing building timber, joists, planks, boards, &c., by kyanizing them would soon be saved in decreased expenses for insurance. The suggestion is a good one. A good fire-proofing solution for timber is, equal parts of alum and sulphate of copper, dissolved in water at the rate of two pounds of these substances to the 40 cubic feet of water.

"Mr. L. V. Bievie, of Akron, Ohio, states, that the best way to prepare fire-proof floors is to cover the plank floor with "Blake's fire-proof paint." "It makes," he says, "a beautiful floor, becomes as hard as marble, and is both fire and water-proof."—March 1, 1856.

"In relation to an article in a late number of the *Scientific American* on fires, allow me to give you a few details about the construction of floors in the houses of Paris which you mention. In this city (New York) all the floors are formed simply by nailing boards on the upper face of the joists and laths on the under part, to hold the ceiling. No provision is made to prevent fire from destroying such floors. When a fire makes an opening through the ceiling, the joists and boards of the floor above are soon burned, and the opening which is thus made causes an increase of the flames by forming a draught. And as the same effect is produced on each floor the whole building soon becomes an immense furnace.

"The floors of French houses are constructed as follows:

"When the joists are fixed in their places, some spikes are driven on each face, at a distance of about two inches from each other, and in a slanting position, at the same time the under part, which forms the ceiling, is covered with lathes. The masons then form between the joists wnat is called "les auges" (because it has the shape of an "auge" or trough). The spikes and fibres of the timber give a good hold to the plaster, which is also supported by the lathes of the ceiling on which it is pressed and worked down to the said shape leaving only about three or four inches thickness in the middle and raising against the sides nearly to the top of the joists.

"On the upper face of the joists there is another layer of laths, and on these a coat of old plaster from demolitions, laid on with mortar or plaster, and on this are laid baked hexagonal bricks, which are very generally used. When wooden floors are required some strips of oak are spiked on the coat of plaster above mentioned, so as to take hold in the joists, and on these strips the "parquet" is nailed.

"The timbers of the floors are thus confined between two coats of plaster, and each joist is itself coated with it on its four faces. It is thus that the houses of Paris are secured against fires. No conflagrations like those in New York ever take place in Paris, and when a fire does break out in an apartment, the firemen have only to provide ladders for the windows, through which they can generally soon master the fire—the flames most generally coming out through the windows, having no escape through the floors."—March 15, 1856.

"During the past week, on parts of the successive days a new steam fire-engine was exhibited and operated in the "City Hall Park" of this city, and with gratifying success. The construction of this engine is peculiar—quite different from any other ever brought before the public. The machinery is supported on a four-wheeled truck, made of wrought iron, and resting on elliptic springs, so as to run free and easy. Only one pump is employed—a rotary, of Carey's patent, which is driven by two small oscillating engines of Reed's patent. The rotary pump is placed on the forward end of the carriage, and the two piston rods of the steam cylinders are directly yoked to the central shaft of the pump and immediately behind it. They are set at right angles to one another, working upwards and across the machine, giving the pump a uniform rotary motion. The machinery is thus packed in a very small space, and the pump works without that jarring motion peculiar to those steam fire-engines having fixed steam cylinders and reciprocating pumps.

"The boiler is peculiarly constructed; it is principally composed of a hollow square stack, standing upright, of double tubes having the water enclosed between two heating surfaces, thus exposing a thin sheet of water to a double sheet of fire. Its inventor is Mr. Lee.

"One great object in a steam fire-engine is to get up steam rapidly. From the time the fire was kindled until the steam guage showed a pressure of 80lbs., twelve minutes elapsed when we were present, and the engines then started at a very good speed. At 120lbs., pressure it threw two 1¼ inch streams of water 174 feet horizontally and with perfect uniformity, for nearly an hour. It is intended to light the fire when the engine leaves the house, and thus to have the steam up and ready for work when the engine arrives at a fire."—April 5, 1856.

DISCUSSION.

Mr. Frederick Braithwaite said—having for a long time taken an interest in the subject submitted by Mr. Braidwood, he begged to make a few observations on that gentleman's paper, and on the discussion to which it had given rise. He would commence by offering some explanation with regard to the remark made by his brother on the first evening's discussion, viz., that it was not the interest of the insurance companies to extinguish fires. That remark was not thoroughly understood. The observation really made was, that the insurance companies were fearful, if the public became acquainted with the fact that they possessed enormous means of putting out fires, householders would not insure. He had not been prepared to hear the very excellent letter which had been read from the Secretary of the Fire Annihilator Company. He had always considered Mr. Braidwood to be one of the most superior fire-annihilators of the day, and for the intelligence, energy, and industry he had displayed, the public were indebted to him. He (Mr. Braithwaite) had been professionally engaged by the Fire Annihilator Company, at the time when, by some accident, the premises of the company were burnt down; which gave rise to the remark that the Fire Annihilator Company could not put out their own fire. They would, no doubt, also recollect a facetious article which appeared in *Punch*, relative to an unfortunate accident which occurred to one of the company's machines when tried lately at Drury-lane Theatre, and relative to which a very damaging article appeared in the *Times*. The cause of that accident arose simply from the incautious application of a tube, some 15 feet in length, to the funnel of the machine, which increased the atmospheric pressure beyond what the machine was intended to bear. There was in reality no damage done, but it was sufficient for those who were not favourably disposed towards the invention to condemn it. As well might they say, because an accident occurred to a steam-boiler they were to dispense with steam-engines altogether. He did not go the whole length of the zealous Secretary of the Fire Annihilator Company, who had written the very able letter just read, and he was not so prepared to call it a fire annihilator as a flame extinguisher. It was practically a "steam fire-engine." He could corroborate the letter of the secretary, that by the employment of this machine not only had an immense quantity of property been saved from destruction by fire on land; but on board vessels especially, its value and efficiency had been more particularly tested in saving life. The annihilators were extremely useful as an adjunct to the fire-engines. They ought to go hand in hand. When they heard of the immense amount of property these annihilators had been instrumental in saving, he thought they must feel some surprise that the insurance companies had not yet adopted them. Hundreds of thousands of pounds had been saved to the insurance offices by those fire-annihilators, for which not a shilling had been received from those offices in return, and he therefore thought the subject ought not to be passed over in silence. He hoped Mr. Braidwood would receive it from him as the representative, in some measure, of the Fire Annihilator Company, that their only desire was to assist in the means of arresting fires. He held in his hand a letter which had been received from Mr. Woods, the correspondent of the *Morning Herald* in the Crimea, stating the effects which attended the use of one of those machines in the case of a fire in one of the transport ships in Balaklava Harbour, which he would request the Secretary to read to the meeting. The letter was as follows:—

(Copy.)

Sir—In reply to your inquiries, I beg to give you the following particulars:—

A fire broke out in Balaklava harbour on the evening of the 23rd January, 1855, on board a screw collier, laden with coals and huts. I was on the *Bride*, transport No. 27, lying next but one to the ship on fire, and witnessed the alarm and confusion which the incident created in the harbour. I saw no flames from the collier, but there was sufficient smoke coming from her to show that the fire, wherever it was, had obtained a hold. Suddenly I heard a slight report—the smoke and confusion ceased—and in a few minutes I was told the fire was completely extinguished. I was informed by Capt. R. Liddle (of the *Bride*), and other captains of transports present, that the ordinary means (water) to extinguish the fire having been tried in vain, a fire-annihilator was brought from another ship and used. Its effect, as far as I could judge from what I witnessed and what was reported to me by others, was so instantaneous as to appear magical. If the fire had not been so extinguished, the disastrous results which must have ensued are almost beyond calculation; for in addition to the crowd of transports in the harbour (none of which could have got out) close to the ship on fire were vessels entirely laden with powder and live shells, and adjoining them, on shore, at the edge of the water, were piles of ammunition (powder and shell) amounting to very many hundreds of tons.

I was informed that a portion of the coal on board the collier was coked, and many of the planks burnt completely through.

You are at liberty to make what use you please of this letter; and I sincerely regret that I am unable to recollect the name of the vessel in which the fire occurred. As, however, both the fire and the complete manner of its extinction were much spoken of at Balaklava at the time, you may, with the assistance of these facts and dates, easily obtain fuller information.

I remain, yours very obediently,
N. A. WOODS,
Late Special Correspondent of the *Morning Herald* at the Seat of War.

To the Secretary, Fire Annihilator Company.

Mr. Braithwaite added that he tendered thanks to Mr. Braidwood for having brought before the Society of Arts an exceedingly valuable paper—not for preventing fires, but for arresting and controlling them. He hoped, after the unanswerable evidence which had been adduced that evening of the great value of the fire-annihilator, that the Chairman, in his distinguished position as President of the Metropolitan Board of Works, would direct an inquiry to be made as to the real merits of this invention, with a view to the adoption of parochial fire-annihilator brigades.

Mr. THOMAS PIPER said he had listened with great interest to the philosophical essay by Mr. Bridges Adams on the construction of buildings, which was read at the commencement of the evening; but there were several little practical difficulties which had occurred to him as a practical man. With regard to the general suggestion, that arches should be turned in fire-bricks and with fire-clay the result of that would be that the arch itself would be insecure, because the constitution of the clay was such that when dry it would shrink, and leave each brick detached, and so destroy the arch itself. With reference to the glazed lining of flues, a patent had been taken out by Mr. Hiort for the construction of flues in a circular form, which could be built in any direction, the sides of the bricks being glazed. The objection to this plan was, that the glazing did not hold the soot, and at every shower of rain the drops came down the chimney with their load of soot and dirt, producing thereby great inconvenience and annoyance. He thought the object of the discussion was not so much to theorise on what they might do if they had the requisite materials, as to look at the buildings they did construct, and see how they could render them less liable to the objections which had been made against them. He would first speak to the observations of Professor Hosking, who suggested that the evolution of gases caused timber more readily to ignite at its end. He (Mr. Piper) believed it would be found that when timber was heated to a point to become ignited, the great matter to support combustion was pure air, to supply the necessary oxygen; whilst, if they covered the inflammable material with a thin coating of plaster, it would be seen how the stoppage of the access of oxygen rendered the material incombustible. A perfect plaster ceiling, in the ordinary way, was a good stopper of fire. In a house of his own, in which the ground floor was burnt, the floor above the room in which the fire originated was uninjured, in consequence of the resistance which the fire experienced from the plaster ceiling; and if the ceilings were constructed in this country as they were in France, and as he had constructed them, under the instructions of Professor Hosking, they would be still more resistant of fire. Instead of covering the bottom of the joists with thin lathing, and then putting on a ceiling pushed up from below, in France a movable frame of wood was placed under the ceiling; on this two inches or more of plaster was put on and thrust through from the top; thus an incombustible surface was prepared, which would resist fire. As houses were generally constructed, the spaces between the floors and the joists, and the quarterings of the partitions formed so many flues from top to bottom, and greatly promoted the progress of fire. The flames, on catching the floor, passed through these flues so prepared for them, thence to the skirting, and thus communicated with every part of the house. The practical observation he would make was, that it was desirable to avoid lath and plaster partitions in houses, and also that the ceilings should be thicker and stronger than was the case at present. He believed that the disuse of wood skirting, in accordance with the views of his late friend Mr. Cubitt, would go far to prevent the destruction of houses by fire. The use of plaster for the decoration of doors, &c., would also do much to prevent the spread of fire, and by the improvements in making plaster, by the introduction of Martin and Keene's cement, the building might be made more fire-proof than was ordinarily the case. He had extensively used the method of flooring introduced by Messrs. Fox and Barrett. It consisted of wrought-iron joists, I-shaped. Upon the lower flange were laid laths, and upon these laths concrete was placed, forming the floor. But he found this to result—when the concrete was all loose, each joist appeared to be isolated, but when the mortar became set and indurated, the whole then formed a perfect landing, and if it moved at all it moved together. He had seen these floors adopted to a large extent, and he believed it to be a most valuable invention. With regard to cost, which in this practical age was a most important one, any house could be constructed with this description of floors with the additional expense only of the flooring boards, that is, the cost would be enhanced by the amount of the value of the flooring boards only. Adverting to the communication of Mr. Bridges Adams, not only had Fox and Barrett's floors been extensively used, but the suggestion of Mr. Adams, of flat roofs covered with tiles, so as to form a terrace, had also been employed. But the point was this, when they had to contend with a large body of fire, it was found that cast-iron yielded, and wrought-iron was twisted by the intense heat to which they were subjected. If a building were constructed in the manner suggested by their philosophic friend Mr. Adams, he doubted whether, under the amount of fire with which Mr. Braidwood was familiar, such a building would stand. The point, however, was not so much to attempt to govern a fire when it had got hold, as to give it so little food as to be managed in the apartment in which it originated, and prevent it from spreading. He believed that, by a very simple process, staircases might be rendered less combustible—that was by constructing them as they did in France, filling in the spandrels with incombustible material, instead of constructing them as so many hollow boxes. If the stairs were a solid mass, it would be a long time before the fire would act upon them in such a manner as to render them impassable. He would add one word with regard to the fire-annihilator. Mr. Braidwood had stated that an early and well-directed application of water to the spot immediately on fire was of great importance, and that if the water did not reach the spot on fire, it was useless towards extinguishing the flames; but the vapour from these machines would fill the whole apartment, and to that extent he thought there would be great benefit from their use.

Mr. BADDELEY desired to offer a few words in explanation of some of the remarks which were made at the previous meeting, either in Mr. Braidwood's paper or in the subsequent discussion. Before doing so, however, he wished to state that as, in his opinion, the statistics of fires furnished a most instructive lesson in the way of precaution, and suggested the best methods of prevention, he had prepared some tables illustrative of these matters, which he begged to present to the Society. On reference to the causes of fires, it would be seen that the five classes into which Mr. Braidwood had divided them included four-fifths of all the known causes of fire in the metropolis during the last twenty-three years. Carelessness in the use of fire and artificial light, and in the construction of buildings, occasioned a fearful number of accidents. At the same time, fires would sometimes occur in the most carefully-conducted establishments, from accidents wholly unforeseen, and, for the most part, unavoidable, and in spite of the utmost precaution. A remarkable illustration of this fact took place in December, 1853, in New York, at the premises of Messrs. Harper, printers, booksellers, and stationers. This firm, having suffered severely by fire on a previous occasion, was particularly careful, in rebuilding their premises, to take every possible precaution for the prevention of the recurrence of so dire a calamity. They had a steam-boiler in the basement, but, with this exception, no fire whatever was permitted in the building. The gas-lights were most carefully arranged; the building was warmed by steam-pipes; and the charcoal fires usually employed for heating the bookbinders' tools were replaced by gas jets. Constant care and watchfulness was the rule of the establishment, and a fire could hardly have happened, but for one of those unfortunate accidents which render unavailing all human foresight. Camphine was necessary for cleaning the inking-rollers, but this operation was conducted in a room fitted up expressly for that purpose, and lined with zinc. Some repairs being required, a plumber had occasion to light a lamp, which done, he very carefully threw the match into what he took for a tray of water, but which unfortunately was camphine. The place was instantly in flames, and the whole of the premises, with their contents, valued at upwards of one million of dollars, were entirely destroyed. Spontaneous ignition would be seen to have occasioned upwards of three hundred fires in the period under review, being nearly twenty per annum. Although the fact of spontaneous combustion taking place in cotton, wool, hemp, lamp-black, and many torrified vegetable substances, was tolerably well known at the close of the last century, we were still very much in the dark as to the peculiar laws by which these phenomena were regulated. Mr. Braidwood had stated "that there appears to be some chemical action between heated iron and timber, by which fire is generated at a much lower temperature than is necessary, to ignite timber under ordinary circumstances." This fact was indisputable, but no satisfactory explanation of it had yet been given. The iron (chemically speaking) was by no means essential to the result, because it had been repeatedly observed that roasted bran, coffee, malt, and other vegetable substances, as well as coke, charcoal, and other matters, after being cooled down to such an extent as to be easily handled, had, when laid together in bulk, gradually increased in temperature, until they had eventually ignited. To this phenomena he had given the name of the accumulative property of heat, but could offer no satisfactory explanation of its cause. Mr. Marrable, at the last meeting, supposed that the timber was converted into "touch-wood" previous to ignition, but such was not the fact. The timber assimilated more to the character of charcoal, and ignition took place in these cases at a temperature much below the igniting point of either touch-wood or charcoal under ordinary circumstances. The greatest cause of fire was candles, upwards of four thousand fires having been thus occasioned in London since 1832. But this might have been expected, seeing that candles were almost in universal employment. The next prolific cause of fire was flues, then gas, and under these three heads alone more than half the total number of fires would be found. "The best means of arresting fire" was, as Mr. Braidwood most justly observed, "a very wide question." He begged to differ, however, from Mr. Braidwood, when he stated that, "the only limit to the means is the expense," because he had for years past held the opinion that the best means of arresting fire would be the least expensive. He apprehended there could be little doubt but that with constant water service under pressure, with suitable arrangements for its prompt and efficient application, not only would the loss of life and property by fire be greatly diminished, but the early extinction of fires would be effected at a greatly reduced expense. Such had been the result of the adoption of this principle in Philadelphia, Hamburgh, Liverpool, Manchester, and other places, and such must be the results in London eventually. The present arrangements of the water supply in the metropolis were not yet such as to permit the direct jet from the water mains to be entirely depended upon for extinguishing fires. At the same time these jets were much more available than was generally supposed. They were extensively used at the finish of large fires (as stated by Mr. Braidwood), and might with great advantage be still more extensively employed at the beginning of small ones. It was a very common occurrence for the firemen to find a fire burning in a cellar, or it might be in a shop, the whole of the fire being below or within ten feet of the ground. In such cases a plug was opened, capable of giving a twenty, or even a thirty feet jet, which was abundantly sufficient for the extinction of such a fire. Nevertheless, the engine was set to work, and in a few minutes the fire was put out. In some experiments that were tried on the Southwark mains and services some time back, seven-eighths inch jets from the service pipes were thrown to a height of 30 and 40 feet, and jets from the mains to 50 and 60 feet. In many parts of the New River and East London districts, similar jets had been obtained. He congratulated Mr. Braidwood on the change which a lengthened experience had produced on his mind, as to the efficacy of small machines for extinguishing fire. He had, on many occasions, himself extinguished considerable fires, and had seen other persons do the same, with apparatus almost ridiculously small. Mr. John Braithwaite had given the result of his experience with small extinguishing engines, and he (Mr. Baddeley) considered that the adoption of the hand-pump (or syringe) by the firemen, was one of the most valuable improvements ever introduced since the formation of the present establishment. He had little doubt but that when the firemen gained more confidence in the capabilities of these machines, increased good would arise, and that by means of the hand-pump, or, if the occasion were more serious, of the direct jet from the main, the engines would be in much less request, thus effecting a great saving both in time and money, and reducing the damage done by water to a minimum. The true theory and practice of fire extinction, consisted in covering the largest possible surface with any given quantity of water. With this object in view he had invented the jet-spreader, a great number of which were now in use. They had been found extremely advantageous, especially at agricultural fires. Mr. Braidwood had alluded to the different modes of extinguishing fires which prevailed in different countries, and in different parts of this country, but was not disposed to venture an opinion as to which was the best. The arrangements for this purpose, in London, were peculiar. The legal provisions had now become almost obsolete, and had been to a very great extent superseded by two voluntary associations, having, as Mr. Braidwood truly observed, "no legal authority of any sort." The protection of life from fire was undertaken by a society whose affairs were conducted by a committee of management, and supported by the voluntary subscriptions of the public. The suppression of fire was undertaken by another society, whose affairs were also conducted by a committee of management, supported by the voluntary contributions of a portion of the existing insurance companies. In addition to these we had the parochial engines, of which it was the fashion to speak in the most contemptuous terms. The inefficiency of a large majority of parochial fire establishments had certainly been such as to justify the severest remarks of "Boz" and other writers. When parish engines were first instituted, they were almost the only means of protection against fire then existing; but the increased provision of firemen and engines by the insurance companies, rendered the parish engines of less importance, and the niggardly and inadequate sum devoted to their maintenance and application, greatly marred their utility. The practice of cutting down the Parliamentary fire rewards, by parsimonious church-wardens, or in some parishes repudiating fire-rewards altogether, had worked much mischief. In the populous suburban districts of Kilburn, Kentish-town, Islington, Hackney, Stratford, Deptford, Peckham, Clapham, and many other places the distance of the nearest Brigade engine-station rendered them entirely dependent upon local means for arresting the spread of fires, and where this matter was conducted upon a liberal footing, the parish engine was still found to be a really "noble institution;" and well deserving of public support and encouragement. Mr. Hows expressed some regret, on the former occasion, that no mention of fire-escapes occurred in Mr. Braidwood's paper. Considering the great amount of accumulated experience from which Mr. Braidwood had to select and condense matter for such a paper as could be conveniently read at a meeting, it was too much to expect any notice of what was really a different branch of the service to that in which Mr. Braidwood was engaged. The Protection of Life from Fire was, however, a topic of great importance, and if agreeable to this Society, he should be most happy to prepare a paper upon that subject. With reference to the communication of Mr. Curtis as to the fire-annihilator, Mr. Baddeley begged to observe that the hostility therein laid to his charge was not against the annihilator itself, but against the exaggerated claims and misrepresentations put forward by the inventor. Mr. Phillips proved himself to be a most unskilful fireman, and all his experiments were of a most fallacious character; where no trickery could be resorted to (as at Woolwich), signal failure was the result. Mr. Braithwaite had admitted that the true character of the annihilator was at first misunderstood, and its powers greatly overrated, being brought forward as a substitute for, instead of an auxiliary to, the ordinary means of extinguishing fires. While the experimental demonstrations made by the inventor had been far from satisfactory, the skilful and judicious use of the annihilator by practical men had been attended with the best success, both as a fire extinguisher and as a pioneer to the fire-engines. In these cases its value and importance had been manifest. He would conclude by expressing a hope that Mr. Braidwood might long be spared to preside over the establishment which he had now, for twenty-three years, so efficiently conducted.

Mr. **ROBERT RAWLINSON**, C.E., remarked, that Mr. Braidwood had said, "The Water Companies are generally willing to give any quantity of water, but they object to lay down large mains without any prospect of remuneration;" and further, that "plugs" were generally on small branches, and not on the mains, so that any available head was lost, or destroyed, by friction. The practice of using water from the mains direct in Manchester was noticed, but was not considered applicable to the metropolis. Mr. Rawlinson stated, that what could be done in a small town could be done more economically in a larger one; and after all, improvements to be useful, must be economical. He felt satisfied that the water supply in London could be made as active as in Manchester or as in any lesser town. The question of extinction of fires was most important. It was one which, sooner or later, must engage the attention of the local governing bodies of the metropolis—and must involve an improved system of water supply. It appeared there was a dormant pressure of some 150 feet—that is—150 feet head; but, by reason of friction and exhaustion, there was little or no active head. Water under the present system would not rise from the mains more than a few feet. It was a question well deserving consideration, as to whether some means could not be adopted to make the present mains answer the purposes required. "Head," or pressure, was lost by length of main, by bends, and by any obstruction causing friction. A length of parallel main might have 150 feet head at one end, and might only have a few feet of working or active pressure for fire purposes at the other end. By the erection of what he would call towers or reservoirs of equilibrium, a more even, regular, and effective pressure might be established. The capacities of pipes varied as the squares of their diameters, and their delivery about as the square root of the head, minus friction. Water would, under the most favourable circumstances, rise through the atmosphere in a jet to a height of about two-thirds the head; that is, from 135 feet head, a jet should rise 90 feet. Friction would reduce this. Mr. Beardmore, in his valuable hydraulic tables, detailed experiments with pipes under several conditions as to diameter, length of main, and head, giving the height of jet and volume of water discharged.

IN PRESTON,

From 6-inch main, head 110 feet.

	Height.		Discharge.	
With 1 jet ¾ inch	57	feet	12·5	cubic feet
" 1 "	64	"	14·4	"

The first being during the day, the latter during the night.

IN LANCASTER.

From 8-inch main, head 225 feet.

With 1 jet an inch in diameter, the water rose to a height of 140 feet.

With 100 feet of common hose of 3-inch diameter, the water rose to a height of 80 feet.

Before water could be available under pressure, there must be proper fire-cocks or hydrants. He spoke under correction, when he said that fire-cocks were unknown in the metropolis. A rude wooden plug was driven into an open pipe end, and when water was required for use at a fire one or more of these must be drawn and the stand-pipe must be inserted in the face of the rising stream. Now fire-cocks could be put on the mains, and were in use in all towns where new works were established, which would perfectly command the water. A wine glass might be filled or a jet might be thrown over the adjoining houses. Proper hydrants or fire-cocks might be used for purposes of street-watering. They would be placed at short distances apart, and a water cart, with stand pipe, key, and hose, could fill 250 gallons in 1½ minute of time; at present, carts for street watering all over the metropolis, were filled at pumps; man, horse, and cart, were delayed a quarter of an hour or twenty minutes to fill a cart, and then the same cart had to travel the same ground several times over, full and empty. With hydrants a cart would be immediately filled at any point, and would never traverse useless ground, one cart under improved arrangements doing the work of three as at present, and at one-third the cost. Water in force, was more effective at a fire than where it was merely poured out over it; now force implied volume, and one jet from a street-main might have the force and volume of several hand-engines. The best fire-engines did not throw water more than 95 feet high, and this, in spray. A jet, could be made to rise from one to two hundred feet and upwards. At some of the great cotton fires at Liverpool, it was only the force which knocked the fire out, and not the wetting of the materials. Force and volume of water might be obtained in the metropolis by a proper revision and improvement of the water mains and services.

Mr. **BARRETT** observed, that Mr. Braidwood had stated in his paper that *carefulness* was one of the best preservatives against fire, and no doubt he was right. He feared, however, that so long as we continued to construct the interiors of our houses of a material so inflammable as timber, so long should we have to regret the annual loss of a vast amount of property, and to deplore the still greater evil of a large destruction of human life. It was remarkable that with so subtle and insidious an enemy as fire to deal with, we should still continue to provide, in the construction of our buildings, that description of *food* which was best adapted to that enemy's devouring propensities. But so it was; we were wedded to custom, and it was exceedingly difficult to break through long-established habits. The construction of fire-proof buildings was a subject that had certainly not received that degree of attention which its importance merited. Until within a comparatively recent period, very little had been attempted in that way. Some few of our more important public buildings, some of the mansions of the nobility, occasionally a warehouse, and here and there a cotton, clothing, or silk mill, had been constructed upon a fire-proof principle, namely, that known as the iron girder and brick arch system; but this system was not adapted for domestic buildings, nor was it altogether free from objections. It had been well said that the arch *never sleeps*, it was always exerting a strain upon its supports, which required to be counteracted, and although it was customary to use tie or tension rods for the purpose of resisting this lateral strain, these rods were not always employed, nor when employed were they always successful, and occasionally accidents of a most serious nature had occurred in buildings constructed upon this plan. He could instance many of these, but would refer to only one, that of a large mill in the North of England, consisting of five stories. One of the arches in the upper floor of this building had settled, or sunk, and it became necessary to re-construct it. In doing this, sufficient care had not been taken to strut or keep apart the girders upon which the arch was supported. They, in consequence, yielded to the lateral pressure of the adjoining arches, and the whole range of girders and arches gave way, and fell to the floor below. This floor also yielded to the mass of materials thus suddenly thrown upon it, and so on, in succession, every floor gave way, the entire building becoming almost instantaneously a mass of ruins, and killing 20 persons in its fall. This method of construction could not, therefore, be looked upon as free from objection, nor was it generally applicable. What was really wanted, he apprehended to be this—a method of construction that for all ordinary purposes should be practically fire-proof; one that should combine great *simplicity* of construction with *economy*, so as not to exceed, in any great degree, the cost of a building as generally constructed; and one that should at the same time be applicable to all descriptions of buildings, particularly to those of a domestic character. The system of fire-proof construction, which he had been for many years engaged in carrying out, he believed fulfilled all these conditions or requirements. He would, not, however, trouble the meeting with a particular description of the system, Mr. Piper having already been kind enough briefly to describe it. He would merely observe that by the combination of wrought iron joists and concrete, the floor of each room became in effect a beam of artificial stone, with ribs of iron, the structure possessing great strength and rigidity by the consolidation of these materials. The underside was ceiled much in the ordinary manner, and the upper surface adapted to receive the ordinary flooring boards, or such other finished surface as might be required. Mr. Braidwood had referred to a description of building with which there was confessedly some difficulty in dealing, namely, the large Manchester warehouses, and buildings of that class; but these were the exceptions to the rule—they were the units in the hundreds, even if they bore so large a proportion; and being exceptional cases, they required to be dealt with in an exceptional manner, and arrangements which would be quite unnecessary in buildings of an ordinary character might be adopted with great propriety in these. He thought that in all cases the roofs of such buildings should be constructed of solid incombustible materials, and that there should be as few openings in it, for skylights or other purposes, as possible, —such as were absolutely necessary being, in all cases, double-glazed. A roof so constructed might readily be formed into a tank containing a large supply of water (a plan which had indeed been carried out upon this system some years ago), or cisterns might be formed, as Mr. Adams had suggested in the communication he had made to the meeting. From the reservoir of water thus obtained pipes could be brought down in the corners of the rooms, or most convenient situations, these pipes being furnished with stop-cocks or valves at the level of each floor, where a hose might be permanently attached, affording a supply of water at all times, which by merely turning a cock could be thrown in any direction in the event of fire. If in addition to these precautions, the floors of the building, instead of being constructed of timber, as was generally the case, were formed of incombustible materials, ten or twelve inches thick, he thought there would be little to apprehend in case of fire. It should be remembered that fire itself generated an atmosphere which would not support combustion. A fire would burn but slowly till it had succeeded in burning a hole in the floor, when getting a ready supply of air, and meeting in the floor itself with the requisite fuel, it would extend with great rapidity. But the case was very different when the supply both of air and fuel was cut off, which would be the case with floors such as he had referred to. He had observed, in several instances, in the case of buildings constructed upon his system, where fires of coal and coke *laid upon the surface of the concrete*, had been kept up for weeks together, for the purpose of drying the plastering of the walls, that the difficulty always was, not to put the fire out, but to keep it in, the attendant being constantly employed in going round the building, and stirring up the fires, to prevent their going out. Although in buildings with very large areas without vertical divisions, it might not be possible under all circumstances to prevent serious damage being done, he thought the evil might be very much mitigated; for he felt convinced that in those cases referred to by Mr. Braidwood, where so intense a degree of heat had been generated as even to fuse cast-iron, it had arisen from the fact of the materials of which the building was composed themselves affording the fuel necessary to produce that degree of heat.

Mr. WINKWORTH said, that as the fire-annihilator had been alluded to, he would beg to call attention to the following extract from Dossie's *Memoirs of Agriculture* (vol. I., p. 316 *et seq.*), published in 1768. It should be stated that in these *Memoirs* the early transactions of this Society were recorded. The incident narrated in the extract occurred in the year 1761, as shown by the Society's minutes:—

> "There was another important object of the Society's pursuit, of which they sought the attainment of the end, without regard to any premium or bounty. This was the procuring to the public the benefit of a method of extinguishing accidental fires in houses. There had, at the time this matter was started, lately been an uncommon number of such accidents; and a member of the Society, since dead, who had great zeal to do service to the public, had met with a pamphlet treating of a method of extinguishing fires. Finding it had been proved by experiments publicly made to be effectual, not only in the beginning of fires, but even when they have made some progress, he thought it might be rendered advantageous to the public by being made known through the means of the Society. The extinction of the fires was performed by the use of balls charged with explosive matter, and a fluid that has the property of damping fire, and provided with a match to fire the contents. These balls were to be thrown into the room on fire, and bursting there, produced the effect by their explosion and the action of the damping fluid, which was dispersed by the explosion over the whole surface of the room, and quenched the heat. The pamphlet had been published by Mr. Godfrey, an eminent chemist, who introduced this method here, and had obtained a patent for the sale of the balls. The Society had these facts laid before them, and the pamphlet was produced and read to them, by which, as the method proposed appeared of very great consequence, and, from good authority, to be efficacious, they were determined to use their endeavours to bring it into practice. They were further informed that the grandson of Mr. Godfrey, who had succeeded in his business, was master of the knowledge of preparing these balls, and even had some of them in his possession. On this intelligence, they formed a design of having the experiments tried before the public at large, and applied to Mr. Godfrey for his concurrence and assistance. He consented to furnish, at his own expense, the balls that should be wanted, and to attend and conduct the management of them. It was then resolved to build a proper edifice, at the Society's expense, three stories high, near some extremity of the town, which being set on fire, might give a full opportunity of observing the effects of the operation of the balls. This was accordingly done at a little distance from the end of Tichfield-street, near Marybone; and the building being finished, a

> quantity of wood, faggots, and shavings were put into the rooms of the ground-floor and first-floor. Fire was then set to the combustibles in both rooms at the same time, and when they had taken hold of the wainscot the balls were thrown in, and had immediately their due effect. A part of the spectators, the whole being very numerous, who were not near the building, and, consequently, did not perceive how much the fire had gained upon it before the balls were thrown in, expressed some dissatisfaction and doubt whether the trial was fair or sufficient, on which, it was resolved to repeat it in the uppermost room. This second time the fire was suffered to prevail in such manner, not only on the combustibles put into the room, which were in a copious quantity, but on the wood of the building itself, that the flame came strongly out of the chimney, and forced its way with great violence out of the windows. But, instantly on the explosion of one ball thrown in it, entirely disappeared; and on that of a second, not a spark of fire was found unextinguished by the spectators, who immediately went into the room. The flooring was burnt through, and the wainscot reduced to coal in many parts. This removed every surmise of doubt of the efficacy of the operation, and the Society confirmed afterwards the resolution the committee then passed, 'that the experiment had answered to the full satisfaction of everybody.' There can be no question made, but that this method will extinguish fires in the beginning, and in many cases, even after they have burnt some time. The only difficulty is how to procure the balls at the times they are wanted. The Society intended by this public demonstration of their efficacy, to induce at least such as are particularly liable to accidents of fire to provide themselves with them, as there are many cases in which they might have been used with success. But notwithstanding what they have done, and Mr. Godfrey's advertising the balls after this trial, very few have taken them. But when fires happened at that time the populace called on Mr. Godfrey to attend with them himself. But, as fires are casualties that do not threaten particulars enough to strike the multitude with a strong sense of apprehension, by degrees the whole of this exhibition of a remedy seems forgot. The Society, however, have shown to the public that there is an easy method by which fires may be extinguished in many circumstances though not in all, and it is to be regretted that their generous endeavours for the public safety are not seconded by some provisions being made for the application of this method on the proper occasions. If the balls were kept in some proper places in each parish, as engines and buckets are, where recourse could be quickly had to them on any emergency, they might certainly be rendered preventive of some of those fires that are extremely calamitous and now so frequent."

Mr. SAMUEL GALE requested permission to read a notice of a somewhat similar experiment to that brought forward by Mr. Winkworth, which appeared in the *London Journal* for Saturday, December 15, 1722. It was as follows:—

> "From Paris we have an account that, on the 10th inst., an experiment for extinguishing of fire by a machine, invented by a German, was tried in the Court of Invalides there, in presence of the Cardinal du Bois, M. Le Blanc, Secretary at War, and several of the nobility. One of the barracks was filled with faggots and other combustible materials, and set to fire. When it was all in flames, M. Le Blanc ordered the German to extinguish them. The machine was a vessel fixed upon a small wheel carriage, and contained about half a hogshead of water. In the middle of it was a kind of granado, with a match fixed to it by the bunghole of the vessel. The match being lighted he withdrew, and immediately the granado and vessel burst, extinguishing the flames, although they mounted to a considerable height above the barrack. The German and his people then entered the barrack, and entirely put out the remainder of the fire with a few buckets of water. The experiment gave thorough satisfaction to the spectators. The only difficulty which seems to attend the operation is, how to get the machine in time to the upper floors of houses.'

Mr. Gale then alluded to the statement made by Mr. Braidwood, that a chemical action went on between hot-water pipes and timber, tending to produce fire at a lower temperature than ordinary, and that on that account hot-water pipes should not be fixed within three inches of wood. An experience of more than thirty years taught him that this was not the fact. As proof, in some degree, on this point, he produced a small piece of wood, cut that morning from a floor board, which had been *in contact* with a hot-water pipe in constant use for eighteen years. Further, he had carefully examined one of the largest hot-water apparatuses in London, where the pressure was at least forty feet, and here he did not find any signs of chemical action or charring of the wood near the pipes; indeed, the wood bearers, on which many of the pipes rested, were as fresh and free from defect as when first put in. He believed that there was no means for producing artificial warmth so free from danger as low-pressure hot-water apparatus. It was important that this should be understood, for, by a clause in a recent Act of Parliament, the fixing of hot-water pipes within the distance described by Mr. Braidwood, had been prohibited, thus preventing the use of one of the greatest means of comfort, unless at a great outlay, or in houses specially constructed for the purpose, and interfering with a very important branch of business.

The CHAIRMAN said he was confident he should only express the sentiments of the meeting by moving a vote of thanks to Mr. Braidwood for the valuable paper he had laid before the Society. That paper had led to a discussion upon many very important points, and he trusted that the result of that discussion might be an improvement in the means of annihilating fires. It could not, he apprehended, be doubted but that a strong impression must have seized the mind of every practical man present as to whether the organisation of the Fire Brigade was one that was either satisfactory to the public or safe to the community at large? No doubt the insurance societies, who bore exclusively the cost and charge of this establishment, had a direct interest in sustaining that establishment in the most efficient manner. He was ready to confess that the statement which had been made in the course of the discussion—that the insurance companies had an interest in property being destroyed by fire—had had no effect whatever on his mind, believing, as he did, that the insurance companies must evidently have a direct interest in putting out every fire which might be ignited within the metropolis. The very fact of keeping up an establishment at so serious a cost to the companies themselves, must be sufficient proof that they had an interest—a commercial interest—in extinguishing fires as speedily as possible. But how far the present system was one that ought to remain satisfactory to the metropolitan public was a question in his mind anything but settled. It was not for him—especially in the peculiar position which he had the honour to hold—to indicate that kind of organisation which should supersede or act as an auxiliary to that which was already in operation; but for that metropolitan public, who were so largely taxed by government upon an act of the first prudence—viz. the insurance of their property. He could not but feel that the metropolitan public, so taxed, had a right to ask from the government some protection to their lives and property in return. And, at the same time, he could not admit that the insurance companies had no interest, or should not be called upon, to contribute towards an establishment that would so protect the lives and the property of the metropolitan public. How that arrangement was to be made, and what should be the future management, was a question which he could not venture to indicate; but that some more extensive organisation must be established, must be apparent to all who had listened to the discussion. They had, in their friend Mr. Braidwood, that which inspired confidence; wherever his presence was seen, they had the security of property. He had always admired the operations of the Fire Brigade; for wherever they took possession of premises under the influence of fire, the property then liable to be destroyed, so much of it as it had been possible to save, had been perfectly safe in their keeping. Moreover, the Brigade exercised the most diligent and anxious care for the lives of the inmates and the protection of the public at large; and the rules—the very stringent rules which Mr. Braidwood had introduced into his establishment—were as creditable to him as they were beneficial to the public

He trusted that the issue of the discussion might be that the system of protection to the public might be increased; and he was sure nothing had given him more pleasure than to listen to the very practical paper which had been laid before them, and to the discussion which had followed. He hoped that Mr. Braidwood's life would long be spared to the metropolitan public, who already owed him so deep a debt of gratitude. He (the Chairman) had therefore great pleasure in proposing that their thanks be tendered most cordially to their friend Mr. Braidwood for his valuable and highly interesting paper; and he trusted that the result of it might be more than even the most sanguine anticipations could have depicted to his own mind.

Mr. BRAIDWOOD said he was very much gratified by the handsome manner in which the vote of thanks to him had been proposed, and he accepted it with pleasure. At that hour of the evening he would only slightly advert to one or two matters introduced in the discussion of the previous evening. Most of the speeches on that occasion, he thought, answered each other, but there were, nevertheless, one or two points for notice. In the first place, he would remark that the paper itself was very far from being a full and explicit explanation of all that might be said on the subject of fires. If he had attempted such a thing it would have been unsuited to this or any similar society. He had endeavoured to make the paper as interesting and as useful as he could in the limits to which he was restricted. Mr. John Braithwaite had expressed an opinion that the insurance offices were not anxious that fires should be extinguished. The brother of that gentleman had, however, in some degree, qualified that remark. During the last 30 years no fewer than 186 insurance offices had been in existence, but there were not now more than 70 doing business in the three kingdoms, or, in other words, nearly half the number had been unable to obtain premiums enough to pay their losses and ordinary expenses. It could hardly be supposed that if one-half of the offices were broken up from such a cause, the other half would be anxious to increase their losses from fire, and, therefore, if they could reduce the number and extent of fires they would do so to the utmost of their power. He knew, from constant communication with the fire offices, that they were very anxious to get fires extinguished, and were ready to do everything in their power to accomplish it, consistent with the due consideration of their own interests in point of expense. He could also state that the subject of steam fire-engines had been seriously considered; but if the fire-offices were disposed to incur the cost which six or eight of these engines would involve, there was not at the present time an adequate supply of water from the mains to work any number of them at a fire. There was scarcely a sufficient supply for ten or twelve of the engines ordinarily in use. Therefore, steam fire-engines—admitting their great efficiency—were out of the question, until a larger supply of water could be obtained. If he might compare small matters with great, he would liken the steam-engines to a battering train—most efficient when well placed and served, but slow of movement, and requiring large supplies. The common fire-engine, well constructed and not too heavy, might be likened to field artillery, which, from its power, but especially from the rapidity of its movement, was invaluable. To carry out the simile, hand-pumps might be supposed to take the place of musketry, which might be used when and where it was desired—from a wash-hand basin, if necessary. With regard to the supply of water, his impression was that when they came to have an adequate supply for steam fire-engines, a higher pressure would also be given, so that they could work from the main, without requiring the steam fire-engine. Mr. Hawes had asked the question, how were houses to be heated? He (Mr. Braidwood) had stated that he considered open fire-places were the safest, if the hearth was not laid upon timber, which might easily be ascertained. Mr. Papworth had stated that stone staircases cracked at the wall; but that arose generally from cold water coming suddenly in contact with the stones when much heated, and thus fracturing them; but if a house were built with brick partitions and solid floors, there was little probability of a stone staircase becoming disabled from such a cause in an ordinary house. Mr. Papworth had recommended plating of iron; but he (Mr. Braidwood) had never found it succeed. In a fire at the Bank of England, the hearth on which the stove was placed was cast-iron an inch thick, with 2½ inches of concrete underneath it; but the timber below that was fired. In the case of a fire in a timber building, used as a wadding manufactory, the timber most injured was where it had been covered with sheet iron, which did not allow the water to reach it until the nails were burned out and the iron fell. Mr. Papworth had also alluded to the authority given in Paris to break open the doors of houses on fire; here it was one of the most arduous tasks of the police to keep them shut till the means for extinguishing the fires were ready; necessity was the only excuse for breaking open a door here without a magistrate's warrant, and it seemed a very salutary restraint to prevent useless damage. He remembered but one prosecution againt the Fire Brigade for breaking open a door, but the necessity being proved by the neighbours, the firemen were exonerated. There were several continental laws as to fires that would not suit here. In France the people were compelled to work the engines without pay, here they were paid 1s. for the first, and 6d. for each succeeding hour. A great deal had been said about insurance in France. There was a curious law in the Code Napoleon, which enacted that if A, B, and C lived in adjoining houses, if B's house took fire, and A and C were damaged thereby, B must pay the damage as well as bear his own loss, unless he could show that there was no carelessness on his part, that was, prove a negative; but to get rid of this, B insured his own house for 10d. per cent., and each of his neighbours for 5d., they, of course, both paid 5d. for him, which made 1s. 8d. per cent. on each house; this, with the average clause, made a common insurance about twice as expensive as it was here. This also caused the amount insured in France to appear very large, great part of the property being covered three times over. With regard to parish engines, he might mention that in Hackney, there were five good engines provided with horses, and a staff of six or eight men to work them. This had been done out of the parish funds, whilst another parish, which might be presumed to be equally as wealthy as Hackney, were endeavouring to effect the same object by subscriptions, although they had the same right to pay the expenses from the parish funds as the inhabitants of Hackney had. Mr. Rawlinson had mentioned the matter of fire plugs. He (Mr. Braidwood) apprehended that was not a matter with which the water companies had to do. It was the business of the parishes to put proper plugs on the mains. There were as many as 40,000 or 50,000 plugs in London; and he apprehended to fix the fire-cock alluded to by Mr. Rawlinson, would cost about £5 a piece.

Mr. RAWLINSON said, fire-cocks might be purchased for 20s. each, and be fixed for 7s., 10s., or 20s. each in addition. The cheapest fire-cocks cost, fixed, not more than £2; the most expensive cost, fixed, not more than £3 10s. The cheapest were ball-valves; the dearest, screw-valves of brass, with brass fittings complete. The estimate for fitting up the metropolis with proper fire-cocks would therefore be, taking the larger number, 50,000, mentioned by Mr. Braidwood, £100,000 in the one case, and £175,000 in the other. These sums, he considered, were no great matter for so important an improvement to the whole metropolis.

Mr. BRAIDWOOD stated, that these fire-cocks were in use at the Exhibition of 1851, and that considerable damage was caused by stones getting above the ball, so that the water could not be shut off.

Mr. RAWLINSON said, he never, in the use of many hundred ball valve fire-cocks, met with such a case. The water must be in a sad state in which there were stones and dirt enough to render a ball valve inactive.

A **Gentleman** inquired whether Mr. Braidwood could furnish the comparative number of fires in London and Paris.

Mr. **Braidwood** said, he could not do so at that moment, although he was in possession of those statistics. In Paris they had a brigade of 840 firemen, and, as had been stated, the floors were mostly 3 inches thick of solid plaster, extremely uninflammable. Messrs. Fox and Barrett's system of fire-proof flooring was the one he had alluded to in the paper, as being, practically, the best within his knowledge, but he did not mention any names, preferring not to do so. With reference to the fire annihilator, he was sorry to be thought to cast any slight upon that invention. He had purposely avoided mention of it, inasmuch as he had seen several, and heard of more, experiments with the machine which were not successful, and if an invention failed when experiments were tried, it was open to the impression that it might fail when brought into actual operation, and he had heard of many cases where the machines had met with accidents,—that at Drury-lane Theatre amongst the number. Therefore, he did not wish to say anything about it. His impression, however, was, that water would do whatever the fire annihilator could accomplish, and would also do many things which the annihilator could not. As it was, they had some 40 or 50 different articles to carry with each fire engine, and to add to them such unwieldy things as fire annihilators, would be to encumber the men more than they were at present, with a very doubtful prospect of advantage. He would only add, with regard to the 15 feet of tubing, which Mr. Braithwaite said caused the accident at Drury lane, that the tube was applied by one of the Company's own men, who ought to have been acquainted with the properties and capabilities of the machine he was using.

The **Secretary** has, since the meeting, received the following communication in reference to the discussion reported above:—

Office of the Fire Annihilator Company,
105, Leadenhall-street, London, 21st May, 1856.

Sir,—At the meeting of the Society of Arts on Friday evening last, Mr. Braidwood, in acknowledging the vote of thanks, replied shortly to the different points which had been raised. He (*inter alia*) put in a defence to the communication which I had the honour to address to you, and which was read at the commencement of the evening's proceedings. I rose to reply, but was checked very courteously by the chairman.

As I had not the opportunity of reply at the meeting, I beg you to insert this letter in your next publication.

Mr. Braidwood stated that he had purposely omitted reference to the Fire Annihilator; that he had witnessed experiments which had failed; that a machine had blown the hose off, and then alluded to the accident at Drury-lane Theatre, noting, at the same time, Mr. Braithwaite's explanation.

Mr. Braidwood cannot surely intend that the above shall be taken as his answer to the case which we have put forward.

The experiments to which Mr. Braidwood referred took place in 1850, *more than five years ago.* We can afford to give Mr. Braidwood the full benefit of any objections which he can found on those experiments. In the first working of an invention insufficient results, and often failures, ensue. Experience suggests improvements, so with the Fire Annihilator. During the intervening five years much has been done. The several successful trials at Liverpool, Manchester, Leeds, Stockport, Portsmouth (by order of the Lords of the Admiralty), Gravesend, Millbank (before members of both Houses of Parliament), Lord Derby's, Knowsley, Battersea (before Sir J. Herschel and others, Jury of Great Exhibition, 1851), and other places, and the still more conclusive evidence of facts of use at casual fires, recited in my former letter, fully establish the practical character of the instrument, and nullify any conclusions drawn from first experiments. The fact of the vapour having blown off the hose proves only that the hose was not suitable. The occurrence at Drury-lane Theatre was accidental and exceptional, and has no bearing on the sufficiency or otherwise of the machine. In support of this explanation, we may fitly quote the following observations of Mr. Arden—one of the Committee of the theatre, and a fellow of your Society—contained in a letter bearing date the 26th ult.:—"It is much to be regretted that your experiments with the fire-annihilator, at Drury-lane Theatre, the other evening, should have failed. However, I believe that it was purely accidental, and no proof of the inefficiency of the annihilator, if properly brought into action in case of fire. . . . My confidence in the utility of the annihilator still remains the same." The explanation by Mr. Braithwaite, that the pipe used was too long, was an error. Mr. Braithwaite not being aware of the facts, I did not correct the misapprehension at the time, because I was unwilling to intrude upon the notice of the meeting on a point immaterial to the subject under discussion, and felt also that any such correction would be discourteous to a gentleman addressing the meeting in our favour; and I now simply note the error in reply to Mr. Braidwood's observations.

Mr. Braidwood has not answered our FACTS.

It is open to Mr. Braidwood to dispute the facts, or to show that the facts adduced do not justify our pretensions; but it is no answer to refer to first experiments, five years ago, or to adduce the trivial and exceptional occurrences noted above.

Mr. Braidwood having, by his paper, invited discussion, we feel justified in pressing him for a distinct reply to our case of facts; and in order to bring the question to a fair issue, *hereby challenge Mr. Braidwood to justify his neglect of the fire-annihilator as an auxiliary power, in the face of the facts of successful use by the Leeds Fire Brigade and others.*

I am, &c.,
J. E. B. CURTIS, Secretary.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 21, 1856.

The Twenty-third Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 21st inst., T. F. Gibson, Esq., F.G.S., in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Bentley, Richard.
Miller, Capt. Thomas, R.N.
Twemlow, Colonel George.
Tylor, Alfred, F.G.S.

The following Institution has been taken into Union since the last announcement:—

416. Birmingham, Messrs. Chance's Glass Works Library and Reading-room.

The paper read was—

THE BRITISH SILK MANUFACTURE CONSIDERED IN ITS COMMERCIAL ASPECTS.

By Thomas Winkworth.

At the close of the Great Exhibition of 1851, and at the suggestion of H.R.H. the President of our Society, lectures on subjects arising out of it were delivered in this room by some of the most eminent men of the day, on those branches of knowledge which they best understood. The Council have adopted a similar policy during the current Session, and have encouraged the production of papers having more or less reference to many departments of the recent Paris Exhibition, in which British industry was represented. We have had papers bearing directly or indirectly on coach-building, the manufacture of iron, glass, cutlery, and carpets; also on photography and design, the authors of all which were gentlemen competent by experience or acquired information to do justice to their several themes. It falls to me to offer some remarks on a very interesting and important branch of human skill, of considerable antiquity, and affording no ordinary scope for the development of art, taste, and science.

I was for many years, in early life, engaged in the manufacture of silk goods, and have ever taken a lively interest in its prosperity. It is the Class in which I had the honour to act as Juror, both in 1851 and 1855; and on the latter occasion I had the pleasure to find myself associated with the friend who now occupies the chair. It was also my fortune to be selected to report upon the Class in 1851; and, at the request of the Board of Trade, to do the same in 1855. On this last occasion I found it desirable to put myself in communication with several of my co-jurors on the Continent, and to collect, from all available sources, facts and opinions bearing on the subject. Of these I embodied as many as were necessary to the illustration of the points on which I was asked to treat, and intend now to make use of such materials as were left on my hands, in addition to what I have since gleaned, so far as they may bear on the immediate objects of my paper. I may, however, find it necessary occasionally to quote from myself, not perhaps in language but in idea.

As in that report which, with others, has been recently printed, I entered very fully into the history and statistics of this manufacture, it is sufficient for me now to say, that in this country the trade has never been permitted the advantage of free development. Up to the year 1826, absolute prohibition of foreign manufactured silks was the rule—occasional relaxations the exception. The effects of this erroneous policy were painfully evident in the vicissitudes to which all engaged in the trade were from time to time exposed. At length, Mr. Huskisson, the great and undaunted pioneer of those true principles of political economy which have since received such universal acceptance in the modification or repeal of duties on imports, succeeded in removing from our commercial code that strange anomaly which the laws affecting this manufacture presented; and, instead of absolute prohibition, foreign silks were allowed to come in at a duty of 30 per cent. *ad valorem.* As the margin, however, between this extravagant impost and the smuggler's commission of 12½ to 15 per cent. was so great, about half the quantity imported never passed the Custom-house. This was a condition of things so obviously mischievous, both morally and economically, that at length, in the year 1845, the nominal duty of 30 per cent. was reduced to 15 per cent., and, as a result, this illicit trade was nearly destroyed.

With respect to the history of the raw and thrown, or partially manufactured silk trade, it is sufficient for the occasion to say that, except as to complete prohibition, a similar series of "protective" inflictions, up to the year 1845, prevailed. In that year the duty on thrown and raw silks was totally abolished, and English throwsters, who had hitherto been unable to find a foreign market for their surplus organzines and trams, exported, in the year 1854, no less than 205,186lbs., affording thereby almost irrefragable evidence that a similar policy, as regards wrought silks, would be followed by corresponding advantages. It is, therefore, much to be regretted, that the import duty on foreign-made goods should still be allowed to oppress the trade. As a result, we find that whereas our exports of British manufactured silks, in declared value, were, in 1850, £1,202,368, they had only amounted to £1,507,160 in 1854, notwithstanding the increase of population in all civilised countries, from which we might naturally have expected an increased demand. Our imports of similar goods during the same period, and I presume for the same reason, actually fell off, as in 1850 they were £2,480,369, and in 1854 only £2,310,171. On every ground this repressive policy is much to be regretted, but particularly because it limits the export of articles of British manufacture in return, in the production of which the money expended in labour, as in cotton, wool, iron, ceramic, and other goods, is generally so much greater than in that of silk, where the price of the raw material absorbs so large a proportion of the capital embarked in it.

As regards the history of the silk trade of France, it is remarkable that in some respects it resembles that of our own; those engaged in it have had to endure their privations, and to enjoy their seasons of comparative prosperity. These vicissitudes, however, are not so wholly referable to the natural results of the unsound commercial policy which has so long prevailed in that country as with us, but to those political convulsions by which it has been so often disturbed. I indulge the hope that under the sway of the enlightened monarch who now rules the destinies of that great empire, the fetters of monopoly will be broken, and his subjects be permitted to supply themselves freely from the markets of the world.

I am in a condition to produce estimates and returns of other countries where the manufacture of silks is carried on, such as Austria, Prussia, and Switzerland; but, as they are not essential to the objects of this paper, I content myself with again referring those who take an interest in such details, to the report already mentioned, in which may be found the valuable statistics with which I have been favoured by my friends and co-jurors, MM. Hornbostel, of Vienna, Diergardt, of Vierzon, and Battier, of Switzerland. This manufacture is also cultivated to a limited extent in Spain, Portugal, Greece, Tuscany, Turkey, Bavaria, Baden, and Belgium. With the East Indies, on the contrary, a large business is carried on, but the classes of goods therein produced being peculiar to the country, their introduction to Europe occasions no competition of sufficient importance to justify more than this passing mention.

These brief notices will enable us to enter into the other branch of my subject with less difficulty than if I had wholly passed them by. I have now then to inquire into "the *prospects* of this manufacture in our own as compared with that of other countries."

But before I proceed further, permit me, parenthetically, to observe, that I think our members can scarcely have failed to notice that in most of the papers to which I have alluded as bearing on the recent Exhibition, certain points have become, as it were, stock topics of discussion, such for instance as the alleged decadence in British taste and execution, and a disposition to pass off inferior articles as of better quality and value than they really are. I fear that in the course of this paper I shall be obliged to inflict on my hearers some additional considerations connected with them, but I cherish the hope that they will be all exhausted, if not settled, before the close of the present session, so that during the ensuing one, our time may be otherwise occupied. It is not pleasant to feel oneself compelled to admit, qualify, or deny charges which, if true, ought to be exposed, and if false, to be refuted, but it is a duty we owe to the cause of truth, to meet them in a spirit of candour, faithfulness, and charity.

The first difficulty in the way of a more extended foreign trade is, undoubtedly, that which arises out of those anomalies of fiscal exactions to which I have already alluded. So long as France continues to impose a nominal import duty on silk goods of 11, but in effect of 33 per cent. *ad valorem;* and Austria, Prussia, and Switzerland, one averaging from 15 to 25 per cent., an extensive export of our silk manufactures to those countries cannot be expected, nor, indeed, until we repeal our own import duty of 15 per cent. *ad valorem* on the same productions, are we in a condition to urge it on other governments. So alive, however, have the silk manufacturers of Manchester been to the injurious operation of this impediment to the progress of free trade principles, that in 1852 they presented a memorial to the then Chancellor of the Exchequer, desiring its total repeal. Nor are these views as to the injurious effects of high or indeed of any tariffs as regards this trade confined to a section of our own countrymen; they are reciprocated by my enlightened friend M. Arles Dufour, of Lyons, the president of our Class, and the much respected secretary of the Imperial Commission, and by the foreign correspondents already mentioned, all of whom may be considered as the exponents of the manufacturing intelligence of the countries they represented at the Paris Exhibition. In answer to my inquiry as to whether any and what injury would arise from the removal of all imposts on this manufacture, they one and all, without a single exception, declared that whatever the immediate effect might be, the ultimate one could not fail to prove highly advantageous. It is encouraging also to find that other countries besides France and England are exerting themselves in the same direction. In Belgium, in particular, a great effort is being made to obtain the removal of import duties on many important materials, especially on pit coal, iron and cast iron, by "l'Association Belge pour la Réforme Douanière," under the presidency of our energetic friend and member, M. Corr van der Maëren, of Brussels, and I may, I believe, safely add with every probability of success.

I may here also mention, that a congress of representatives from all countries will be held at Brussels in September next, to discuss the whole subject of the commercial restrictions now existing, and to suggest measures for their early removal. I yesterday received another letter from Mons. Diergardt, the eminent silk manufacturer in Prussia, already referred to, in which he says, "The progress of British manufactures, since the introduction of a more liberal commercial policy, will, I flatter myself, be an encouragement to proceed further in the same direction, and thus prove to the world that England does not fear competition. Already many articles of cotton, linen, and wool, can enter free of duty, and if silk, silk mixed, and similar manufactures were also exempted from fiscal imposts, the advantage would be so manifest, that France and other countries would be compelled to follow the example." As Mons. Diergardt, who thus freely expresses himself, is a member of the Prussian Chamber of Representatives, it augurs well for the progress of sound commercial legislation in that country.

But, besides all this as regards Prussia, we have, within the last few days, received pretty authentic information, that the word "prohibition" is to be expunged from the French import code. This, then, is also an important onward move, and illustrates the opinion I have already expressed as to the rapid progress of true principles of political economy in that country.

The next difficulty I shall notice is that which arises out of the much vexed question of taste, for I wholly deny and ignore any and every theory which would imply an inability to produce goods in this country, whether plain or fancy, as perfect in all respects as those of other nations, always allowing for such impediments, if any, as may be ascribed to the varieties of climate. The differences which may and do exist are, in my humble opinion, wholly referable to the greater or less encouragement which manufacturers have to produce particular classes of goods. Thus, those of one country—Switzerland for example—may, from local circumstances, successfully address themselves to the production of a low quality of goods, and thus rival in similar articles those of other countries not so favourably situated, while in France, on the contrary, they may attain a corresponding degree of perfection in rich fancy silks, for which the prestige and demand of ages, so to speak, may have gradually led the way. Although for this, and, perhaps, other reasons, I am prepared to admit that our French competitors exhibit a greater aptitude for invention and combination in design than ourselves, it is not quite so clear that they have arrived at their present acknowledged superiority without committing many offences against the received principles of pure taste. In what these principles precisely consist, doctor's differ, but it is not difficult to say in what they do not consist. I presume we should have no hesitation in admitting that designs, whether woven or printed, which introduce trees, houses, or animals, are hardly suitable for the personal wear of ladies, and that the varieties of the mineral kingdom and the elements necessary to our existence, are still less so, and yet all these have had their origin and turn in France in my day. But of all the extravagant vagaries of a spurious taste, perhaps the one I now exhibit is the most extraordinary. I purchased the material on my first visit to Paris in 1814, and as at that time all foreign silks were contraband in this country, I was obliged to have it made up into a waistcoat, which I actually wore there for a few days, the size and cut of which would hardly suit my enlarged proportions and advanced years. It comprises the profiles and names, woven in satin, of the so-called liberal deputies of that day, such as Lafayette, General Foy, Benjamin Constant, Manuel, Dupont de l'Eure, and others. I also produce some specimens of the first-mentioned style, in which we shall find peacocks and other birds rather gracefully designed and tolerably well executed, except as to combination and colour, but not exactly what would now be recognised as of first-class taste; these I brought from Lyons about 25 years since. In fact, nothing has been too bizarre to be made and sold if originating in France, while, on the other hand, few silks, however exquisite and pure in design, if first produced in this country, can find a ready sale. But it would be unjust to our neighbours to assert that these designs would now be tolerated, or that even when produced they were held in much esteem. A glance at the Lyons department of the recent Paris Exhibition must have been sufficient to convince even the most sceptical, that in skill and taste their designers are far in advance of those of other countries, and no visitors to that superb collection were more ready to acknowledge its claims to admiration than our native producers. If, then, these last are really so alive to what would, without qualification, seem to be a humiliating fact, it may be asked why do they allow themselves to remain in the wake of improvement? I think I can, to some extent, solve the mystery. Fashion, whose laws all who would not desire to be singular must obey, holds her court in France, and the prescriptions of time have confirmed her claims. Her behests are as arbitrary and inexorable as they are capricious, and her votaries must conform themselves thereto, whatever the result as to the suitability of the prevailing style to their figure or complexion. Even the seasons must be reversed if the goddess wills it, and ladies be clothed in designs of marble in the summer and of lightning in the winter, as I have witnessed in days gone by; in fact, to refuse to sacrifice at her altar, would be to avow oneself an infidel to her pretensions and to brave the penalty.

But, after all, are our silk manufacturers so far in the rear of tasteful design as is so hastily assumed? It consists with my knowledge that many of the best designs which are brought out at Lyons have their origin in this country. I know that English buyers in that market often suggest the patterns and mixtures they wish to have made for them, and for which, as the goods are of French origin, the French manufacturers have the credit. I have also seen, in former days, goods exposed in our windows as "real French, just imported," which I knew to be made in Spitalfields or Manchester. Of course, no respectable house would lend itself to such fraud, and it is to be regretted that prejudice should ever afford, as it too often does, temptation to imposition.

So much has been recently said in this room on this question of taste in design, that to pursue it further would on my part, be altogether supererogatory. I am not qualified to enter the lists with such authorities in their several departments as Messrs. Ruskin, Peter Graham, Crace, Whytock, Crossley, Redgrave, and though last, not least, the Master Cutler of Sheffield; most of whom have, during the present session, announced principles with a happy combination of talent, experience, and illustration, to which I can lay no claim. I have listened to their theories and arguments with much interest, and, I trust, some profit; and if I cannot agree with all of them, it is, I suspect, because scarcely any two of them agree with each other. I have, however, arrived at the conclusion, that there are some standards which we can scarcely hesitate to recognise as genuine; that, to appreciate them properly, we must be educated up to them; and that they are not to be confined within the narrow limits of a single style, but are as extensive and varied as the materials in or on which they are to be executed, and the uses for which they are ultimately destined. Towards the accomplishment of these desiderata the establishment of schools of design has largely contributed, as have also the opportunities afforded to the masses in England by the many gratuitous exhibitions of the best specimens of art-manufacture, at Marlborough House, Kensington Gore, and elsewhere, in London, and by similar ones in other great cities and manufacturing districts; and to the more wealthy, by international exhibitions, where they could contemplate, under one roof, the artistic results of the congregated talent of the whole civilised world.

But there is another impediment to the free exercise of manufacturing talent, to which I have already incidentally alluded, but of so important a character that I must again give it prominence.

I am afraid that the prevailing disposition to estimate intrinsic merit by extent of demand, is rather calculated to lower than to raise the standard of excellence. Immediate saleability is with too many esteemed as the criterion of value, and those are bold men who for the sake of personal or national reputation, venture extensively on an independent artistic field of production. There are certainly a few who take more comprehensive views, and place greater reliance on the ultimate triumph of true general principles, but, undoubtedly, the bulk of our weavers are employed in the manufacture of goods to suit the million, and, as a natural result, taste is too generally placed in abeyance or made subservient to pecuniary considerations. Co-ordinately with this demand for inferior goods, a low tone of morality seems to have taken possession of the commercial mind. Stimulated perhaps by excess of competition, or by a desire to acquire wealth easily and rapidly, something very nearly akin to fraud is sometimes perpetrated. The demand for what are erroneously called "cheap" goods, leads to the production of articles in which inferior materials are made still more so, by the adoption of doubtful means for reduction of cost. It is true that many of these fabrics are made to order, and are generally sold to parties who know what they are buying, but I cannot recognise the distinction which producers of this class sometimes endeavour to establish between those who make and those who afterwards sell as genuine, spurious or defective goods. There may be degrees of complicity, and though it may be true that if there were no buyers of such articles there would be no sellers, it is equally true that if there were no sellers, there could be no buyers; those, therefore, who seek for absolution on such pleas, must have a very inadequate moral perception of their social obligations. It would, however, be a melancholy consideration, and require a more extended notice than I could venture upon, if these practices, which are certainly not confined in their character to the silk trade, obtained to any serious extent. We denounce them, it is true, wherever and in whatever manufacture they are found to exist, whether in our food or in our clothing, but I would fain believe that they are the exception and not the rule of modern commerce.

As, however, some compensation for this evil, I have pleasure in recording the fact that, there is probably no manufacture which has groaned less under the incubus of patent law than this. Numerous inventions have been from time to time introduced, principally by the operatives themselves, for the simplification and lessening of their labour, and the more ready production of expensive fancy goods, but with a patriotic disinterestedness worthy of all praise, so far from seeking exclusive advantages, and looking with suspicion and jealousy upon others who may be travelling on the same road of improvement, they have invited criticism, adopted suggestions, and acknowledged obligations. Instead of contemplating, in a spirit of detraction and envy, the talents of others, which is too often one of the unfortunate characteristics of this over-estimated monopoly, I have frequently enjoyed opportunities of witnessing, amongst my own workpeople in former days, their readiness and even anxiety to give honour where honour was due. In this Society, and at a time when we never rewarded patented inventions and improvements—for objections to patent law are not of modern growth—there are some old members who, like me, may remember that amongst the candidates for medals and honours, the most ingenious and numerous of a class were the weavers of Spitalfields. A sense of justice and gratitude has dictated this cheerful tribute to the character of a body of men with whom I have had many friendly contests on important questions of political economy affecting their interests, to whom I owe much, and to whose talents, industry, and exemplary conduct as a body, with less than the average of exceptions, the country is largely indebted. With respect to the almost entire immunity from the repressive influence of patent law enjoyed by this manufacture, even the introduction of the Jacquard loom in 1820 forms no exception. It is true that Mr. Stephen Wilson, by whom it was brought over from Lyons at great personal risk, took out an English patent for it in the first instance, and granted licenses for the use of it, from which he might have derived a large revenue, but finding in a short time that many manufacturing interests were likely to be injuriously affected by the fettered use of the invention, and that to retain his patent would be to shut the door to all improvements upon it, he very disinterestedly and patriotically gave up to the public all right and title to the advantages he had legally secured to himself. In consequence of this, the machine has been adopted, and the use of it extended to many other branches of manufacturing industry, and many improvements, not, perhaps, in principle, but in details, have been effected. It is now applied as well to power as to hand-loom weaving, and, as we all know, the economy of labour and expense is beyond all calculation. Our member, Mr. Edward Wilson, having promised me the favour of his attendance on this occasion, I shall not enlarge further upon the subject, as I have no doubt he will supply any necessary explanations, and more than confirm all the important facts I have adduced respecting his father's claim to the gratitude of the manufacturing interest. I esteem it a great honour to have enjoyed the friendship of Mr. Stephen Wilson from my earliest introduction to active life.

Having, at greater length than I could have wished, brought into review some of the more prominent difficulties with which the British silk manufacturer has to contend in the race of foreign competition, it remains for me to inquire whether, in spite as it were of them, he may not calculate on a continued increase of demand. Undoubtedly the imposition of heavy import duties is a formidable impediment to an export trade, but, except as to the precise market in which he is competing, all nations are on an equal footing. Thus in France the English, Swiss, and Prussian manufacturers are on the same level with each other, but have equally to contend with the protected producers of Lyons and St. Etienne; but in the United States, where no such manufacture is carried on, all competitors have the same chance, the import duty being the same on all. It is here, therefore, and in countries similarly situated, that the productions of manufacturing talent have the freest scope.

At this moment, perhaps, the articles in which the greatest competition exists, both in the home and foreign markets, are of the lower and middle qualities, as in plain silks generally, small stripes and checks, barred or cross-over glaçés, moiré antiques, satins, velvets, &c., in all of which, as well as in many varieties in ribbon, our manufacturers enjoy a fair and increasing share of profitable sale. Even in goods of a higher class, where the cost of production is greatly enhanced by the introduction of different raised textures, involving the highest order of artistic taste and combinations of colour, they are gradually obtaining a position from which it would not be easy to dislodge them. Towards this "consummation so devoutly to be wished," the advantages of comparison afforded by the Paris Exhibition largely assisted. Of this I had some evidence when in that city, one of the largest buyers on the Continent for America having assured me that he was agreeably surprised to find by that means that he could now purchase many kinds of British silks on better terms than those of other countries. I am also informed on good authority that subsequent increased demand in Manchester, for the transatlantic markets, has fully confirmed this opinion. On this point Mr. John Chadwick, a silk manufacturer, of Manchester, who has written to me within the last few days, says—"I can still confirm the opinion formerly expressed, as to the effect of the Paris Exhibition on the export demand for our goods. Orders, perhaps individually small, but in the aggregate considerable, were given in this market for the United States, for the spring trade, and large orders have been given for the autumn. I am informed, moreover, that the goods sent out from hence have proved satisfactory, although there has been a glut of silk goods in the New York market. Indeed, I feel no doubt whatever that we are now (in spite of Government regulations for crippling the silk trade) establishing gradually, but permanently, a footing in the United States. I cannot, of course, pretend to say that all this results from the Paris Exhibition, but there can, I think, be no doubt that to a large extent such is the case." Nor must we forget that the introduction of power-loom weaving has proved to be a powerful lever for the production of comparatively cheap articles, of which no nation is so able and willing to take advantage as our own. I forbear, however, to press these points further, as I flatter myself that the favourable inferences to be drawn from them as to our future, will be readily understood and accepted by the intelligent audience for whose information I have collected these materials.

As this is probably the last occasion on which a paper will be read originating in the recent Paris Exhibition, I may be expected to say a few words as to the position which our English silk manufacturers held in it. They shall only be a few words, for as, in the report I presented to the Board of Trade, I entered rather fully into the question, it is the less necessary I should do so now. Bearing in mind the old proverb, "qui s'excuse, s'accuse," I must nevertheless protest against the display we made therein being taken as evidence of condition, whether of decline or progress, for it is well known, and much to be regretted, that our manufacturers did not respond very heartily to the invitation to exhibit, and that the greater number did not exhibit at all. The inconveniences and pecuniary sacrifices to which they were exposed in 1851, without deriving, as they believed, any compensatory result, had indisposed them cheerfully to submit to a fresh demand on their time and property; for, on that occasion, they were not only required to be ready long before the inauguration of the Exhibition, but had no uniform, lofty, and adequate space assigned or allowed to them. Their French competitors, on the contrary, had both time and space placed at their disposal, of which they did not fail very fully and freely to avail themselves. But this actual, though probably not intentional unfairness, was not the only annoyance of which they had reason to complain. In consequence of the rule which then permitted and even invited other than original producers to exhibit, many of them found portions of their manufacture exposed to competitive view, which being made to order and with only a limited discretion as to price, design and combinations of colour, had no claim to peculiar merit. In addition to all this, it must, I fear, be admitted, that the theory of international exhibitions is comparatively new to our manufacturers; they do not generally believe, nor indeed do I, that the award of medals is conducive or necessary to the profitable sale of their goods, and are content with those legitimate channels for the disposal of the products of their skill and industry which are open to all. I trust, however, that should another opportunity of the same kind ever present itself, it will be readily embraced, for the necessary rules and arrangements are now better understood, and it must be admitted, that on the late occasion, the appropriation of space was fair both as to quantity and locality. I cannot doubt that future Exhibitions will be conducted on similar principles of liberality and equity. At the same time I am not without my fears, that if at any future international exhibitions the Jury system be continued, many of our manufacturers, especially in this particular branch of industry, may still hesitate to become competitors. Although the number of medals and other distinctions awarded to them on the recent occasion, bore a fair proportion to those assigned to other exhibiting countries, the matter-of-fact character of our nation prevents us from recognising in the decisions of jurors anything approaching to a correct test of relative merit. This question has, however, been so ably and fully discussed by Mr. Cole, in his recent report to the Board of Trade, that I refrain from noticing it further than to suggest that intending exhibitors on any future occasion may, if they choose, make it a condition that in the event of the Jury system being still continued, their collection may be exempted from its operation.

The advantages of the theory of periodical international exhibitions are too patent to require further comment. If they have already resulted in a more extended commercial intercourse; in a better appreciation of what is worthy of admiration in national character; in the cultivation of civilising influences in countries where they have been hitherto but imperfectly understood, and in the removal of long cherished prejudices, they have only realised the expectations of those of this venerable Society with whom the great experiment originated. I, of all others, might without undue assumption well claim for us this merit, if it were for a moment a matter of doubt, for I had the honour to occupy the chair of the Council on the 26th of July, 1849, when the question of a national Exhibition was finally discussed; to urge its impractibility, from past experience under our roof; to suggest the probability of one to be "open to all the world" being extensively and profitably responded to; and to assist in drawing up the memorable resolution on which the realisation and triumphant success of the project was founded.

It only remains for me to request attention to the many specimens with which I have been favoured, by Messrs. Walters and Son, of furniture silks of their own manufacture; by Messrs. Jackson and Graham, of similar goods of Irish, India, and French manufacture; by Messrs. Swan and Edgar, and Messrs. Lewis and Allenby, of garment silks of British and of French manufacture; all of which are, to a certain extent, illustrative of the present condition and relative merits of the countries in which they were made. But, as they were not collected with a view to an ordeal of this nature, and the greater part are supplied without the consent, or even the knowledge, of the original producers, we must not look upon them as other than proximate evidence of ability in their several departments.

I think they will fully confirm the various opinions I have ventured to advance in the course of this paper, and afford us additional encouragement to believe that, "all other things being equal," a vast field for the profitable investment of capital exists in the silk manufacture of this country.

DISCUSSION.

The **CHAIRMAN** said, if his friend Mr. Winkworth had read this paper in the year 1846 instead of 1856, he knew the question that would have occupied the greater part of their time that evening, viz., the great question of free trade. That subject was, however, set at rest; at the same time, there were many important points arising out of the paper with regard to our silk manufactures—the markets into which we might introduce our goods, as well as the kind of material adapted for the export trade. The question of taste was a very inviting one, and there were probably gentlemen present who might think the British national taste should not be so much despised as it sometimes was. Another important question was that of low prices and cheap goods, which required to be well discussed.

Mr. **DILLON** said he had not come prepared to address them in detail on this subject. It was, however, one to which they were doubtless aware he had directed his attention for a great number of years. The thing which most struck him in the very able report of the gentleman who had favoured them with the paper that evening, was the very different position in which the silk trade of this country now stood from what it formerly occupied, and the different point of view in which they should regard it. It was now more than a quarter of a century ago since he addressed a public meeting of the silk trade on the subject of free trade in reference thereto, and it was only with great difficulty that he could obtain a hearing, and this led to his addressing a series of letters to the *Times* newspaper, under the signature of "Delta," by which he was exposed to a good deal of obloquy—he was going to say danger, and which also led to some difficult legal proceedings. He mentioned this to show the difference of opinion in the public mind at that time as compared with the present. Many would remember that not only was depression to the English silk trade predicted, but its total extinction was prophesied as the results of free trade in that commodity. It was maintained that our home trade would be completely destroyed by foreign competition. He remembered when the Jacquard loom was first introduced, that it was taken to Coventry, for the purpose of being applied to the ribbon manufacture; an objection was then made to it that the roofs of the workshops were too low to admit it. It did not seem to occur to the parties that if they could not reduce the loom they could raise the roof of the buildings. A curious instance occurred of the malignity with which the question of free trade in silks was received. A celebrated manufacturer in the City, who attended a sale of East India silks, showed him, on the fly leaf of his catalogue, a full-length effigy of Mr. Huskisson, hanging in chains. Mr. Dillon said he had not come prepared with statistics, but, in fact, the best statistics were amply furnished in that room. The country that could produce the specimens now before them scarcely need to enter upon the question of taste, and need not defend itself on that ground. The question of prohibition in this country was at an end, and the hope existed that the same policy would, ere long, be adopted in other countries. But there was another thing which should also cease to exist—that was—what was called encouragement by means of duties. Freedom of trade would never be fairly established until the rule obtained,—that taxes were levied for revenue only, and not for the purposes of protection—and that, too, for the supposed good of the parties who were thus considered to be protected. He remembered at the time he alluded to it was said, that the silk trade of this country required fiscal protection, because it was then in its infancy—an infancy of nearly 200 years!—and in infancy it would still have remained if it had not been relieved from the so-called protection. With regard to the comparative manufacture of different countries, it could not but be admitted that climate and other local circumstances were more adapted in some countries than in others for the production of a particular fabric; but it did not follow that England could not produce good manufactured silks. It might be that the class of silks might be different in England from those in France. If prohibition were removed, and taxation for the purposes of protection abolished, he was persuaded that a great intercourse would exist between England and France, and manufacturers both in England and France would be mutually benefited and improved by the competition which would exist between them. If it had been his intention to have addressed the meeting he could have brought with him some specimens of English manufacture many years ago, of which they would never be ashamed. He was, indeed, persuaded that nothing had more tended to improve the English manufacture of broad silks, ribbons, gloves, &c., than the competition into which they had been forced by the introduction of French goods. There was another thing of which they need not be ashamed—and that was—that the French manufacturers admitted that they too had been benefited and improved by their commercial intercourse with the English manufacturers and the consumption which the English market afforded. As he had before said, the benefit and improvement were mutual. On the subject of taste it was a difficult thing to form an estimate, but his own impression was, that for the purposes of manufacture the English had quite enough taste. He thought, in the discussion of this subject, too much importance was attached exclusively to the subject of mere taste. The silks which ornamented that room were intended for *use*. He, of course, did not object to beauty of pattern or design, but he thought too exclusive importance was attached to pattern, taste, and colour, and even if the French excelled in taste and beauty in their superior articles (although he saw specimens now before him which disputed that position), still in the English manufactures they had the useful article for the hundred, the thousand, and the million. He now came to a subject which was a difficult one to touch upon—that was cheapness. He submitted that there was a serious objection to the attacks that were frequently made upon cheapness, as injurious to our manufacture. If an article, sold cheap, were a forged article, purporting to be what it was not, then, indeed, cheapness was objectionable, but he contended that cheapness, so far from being an injury, was a benefit. Besides, the representing a thing to be different from what it really was, was not confined to cheap, but might equally extend to dear, goods. He thought it was quite a mistake, and his friend who had read the paper must excuse him if he combatted his opinions on that subject. He thought it was a mistake to represent the English public as so devoted to cheapness, that the manufacturer, in seeking cheapness, destroyed quality and depreciated the goodness of the articles. If a thing was charged a certain price, and was worth as much as was charged, there was no deception. Silk, unlike Barry's picture, was an article of use and comfort, as well as of taste, and the improvement in the manufacture, the talent and the skill displayed in the making of a cheap article, extending the luxury from the hundreds to the thousands of the people, was a national advantage. Nothing, he thought, would tend more to the removal of all prohibition than the petition of the people of Manchester, for the removal of all taxes except taxation for the purposes of revenue; and that there was that talent and enterprise amongst the manufacturers of England that would enable them successfully to maintain their competition with the world, no one could doubt.

Mr. **EDWARD WILSON** said, his name having been unexpectedly introduced in the paper—and that of his father—perhaps naturally so—as the introducer of the Jacquard loom into this country, it might be expected that he should offer a few observations. In looking at this paper as to the prospects, compared with other countries, of the silk manufacture, they must go back to the difficulties with which the trade in former periods of our history had had to contend. The origin of the silk trade in this country, he thought, might be dated from the period of the repeal of the Edict of Nantes, when refugees from religious persecution came over to this country and settled at Canterbury, and there produced an article composed partly of silk and partly of cotton, which obtained the name of "Canterbury muslin." These refugees aftewards migrated to Spitalfields, from which period the silk manufacture of this country might be dated. He could not state the year, but in consequence of depression in the trade, some turbulent outbreak occurred amongst the weavers, which resulted in the passing of the Act called the Spitalfields Act, which authorised the magistrates sitting at Clerkenwell to fix the prices which the manufacturers were to pay the journeymen weavers for their work. Mr. Wilson then proceeded to give an interesting history of his father's detention in France, at the conclusion of the short peace of Amiens, in 1802, which eventually led to the introduction of the Jacquard loom, which he brought over under circumstances of great personal risk. He also gave an account of the vexatious proceedings that occurred between the weavers and their employers, alluding to the exorbitant demands that were made by the workmen for the production of any new and superior fabric or design either in silks or shawls; but, he remarked, at that time both the manufacturers and the weavers appeared to be doing well. He then alluded to a pamphlet of the day, which was published anonymously by his father, after having been revised by an eminent member of the firm with which Mr. Winkworth was formerly connected. This pamphlet exposed the abuses to which the trade was subjected under the operations of the Spitalfields Act, and he believed it was mainly instrumental in bringing about the repeal of that Act. Having alluded to the difficulties which attended the first introduction of the Jacquard machine, and described the various mechanical difficulties that had to be overcome before the loom was brought into successful operation in this country, Mr. Wilson passed in review the incidents connected with the reduction of the import duty on silks, under the measure introduced by Mr. Huskisson, and the effects which that measure had produced upon the trade generally. He then remarked that from that period might be dated the success of the silk trade in this country, from its being able to rival that of the foreigner; and he had no hesitation in saying that, if they had the same markets, and could get rid of the surplus stock of fancy silks made in this country, there was no country in the world more capable of producing a fabric perfect in manufacture, combined with artistic excellence. Mr. Winkworth seemed to regard the falling off in the imports of foreign silks as a matter of regret. He (Mr. Wilson) could not say he regretted it, because he believed it would be found that the falling off in the introduction of foreign goods was occasioned by their being superseded by our own manufactures, the manufacturers of England being better able than formerly to produce that which suited the taste and the markets of this and other countries. Upon the subject of the artistic taste of the day, as to the articles which were most in use, Mr. Wilson proceeded to mention the changes which occurred in the taste of the people—instancing the fact that at one period no gentleman would use any other handkerchief than the Indian Bandannah; whereas, at the present period, that article appeared to be entirely discarded, and almost unsaleable. The plain Corahs were now adopted in their stead; and this change of taste and the imperious dictates of fashion, he said, had often produced the most disastrous results to the manufacturers.

Mr. **PETER GRAHAM** mentioned that the particularly splendid specimen of furniture silk to which allusion had been made, had been manufactured for the decoration of the new ball-room at Buckingham Palace, and was certainly a *chef-d'œuvre* of Messrs. Walters and Son, by whom it was manufactured. With reference to the comparative excellence of the silk manufactures of England and France, in the branch with which he was most acquainted (furniture silks), he thought France had the market of the world, and that in that department France would maintain a superiority which the English manufacturers could not rival until they were prepared to embark colossal fortunes in the trade; at the same time, he believed there was no branch of the trade in which more progress had been made during the last 10 or 12 years than in that to which he had alluded.

Mr. **STEPHEN LEWIS** referred to the benefits that had been conferred upon the silk trade by the reduction of fiscal duties, upon broad silks in particular. He attributed much of the success of the French manufactures to the very complete organisation of the trade which existed in that country. With regard to the alleged superiority of design in the continental manufactures, he thought it was owing, in a great measure, to the art of designing being made a profession, for which a suitable education was imparted; and another advantage was, that the designers were kept in constant intercourse with the manufactures and the buyers. With regard to silk fabrics, he thought the specimens exhibited by the School of Design were as good samples of garment silks as could well be imagined.

Mr. **BRAY**, of Coventry, at some length took up the question of cheap goods as applied to the manufactures of that town; cheapness, in many cases, he said, partaking of adulteration. With regard to the superiority of the French, both in design and colour, he attributed it, in a great degree, to the national character—the love of display and effect. He referred to the facilities afforded to the ribbon trade of Coventry by the application of the Jacquard loom and steam power to silk as well as to cotton manufactures, and he had no doubt that the manufactures of England would eventually be adapted to the requirements of all the markets of the world.

Mr. **WEBSTER** (of the firm of Cornell, Lyell, and Webster) replied to some of the remarks of Mr. Bray, with reference to the cheap productions of that town. He thought one great evil connected with the manufactures of Coventry, consisted in the fact that, if one house produced a really successful article, some of their neighbours would bring out a lower quality of article, of the same pattern, and sell it at a lower price in the market, thus destroying the benefit of the manufacture to the parties who had introduced it. He agreed with Mr. Lewis in the opinion, that the superiority of French designs was owing to that branch being made a profession, for which the members were properly educated. In some houses in France, as many as twenty or thirty designers were employed; and, in one case, he found that ten or twelve persons were employed in designing patterns for silks from arrangements of natural flowers. To keep up a supply of new designs, it was requisite that designers should have intercourse with each other—thus gathering ideas from one another. He knew an English house which engaged a designer at £500 a-year, but he was worked up in six months.

Mr. **WALTERS** remarked that, in his opinion, an extensive demand for furniture silks would enable the English manufacturers to equal the productions of France, both in quality and design. He believed the manufacturers of this country were equal to anything that might be put upon them.

The **CHAIRMAN** wished to add his testimony to all that had been said by Mr. Dillon and Mr. Wilson as to the mischief that occurred to the silk trade from the monopoly that existed some 30 years ago. In fact, the silk trade had been made the scapegoat for almost all the sins of monopoly in this country. They had happily got over those times, and he was glad to hear that they all agreed that the silk trade of this country had taken a very different position from that which it formerly occupied—that it had assumed an important position in the manufacturing industry of the country. He thought it was one of those branches which had derived the greatest benefit from the encouragement which the nation now seemed inclined to give, by the facilities offered, for the instruction of the artizan in the arts and sciences. Last year he spent some time in Paris as a juror of the Exhibition, and on one occasion he fell into conversation with an eminent Lyonese silk manufacturer. He was looking over some of the beautiful productions exhibited, and expressed his admiration of some peculiar kinds of silk fabrics. The manufacturer replied, "Yes; they are very beautiful, and you would be surprised how much we owe in a work of this kind to the workman himself. It is a common practice (he added) for the manufacturer, the designer, and the customer, to agree in the general design of a pattern. We agree in the way it is to be worked, and after that it is my custom to send for the most skilful of my weavers to give him a general idea of the effects to be produced, and to ask whether he can suggest any improvements. The weaver takes it away, puts it into his loom, and it rarely happens that he does not bring it back with some improvement that I could not have devised, from my want of practical knowledge of the working, which, however, he is able to discover; and many of the effects you see here, are, no doubt, the result of the skill of the workman himself." He (the chairman) trusted the same would be the case with the Manchester and Spitalfields operatives. It now only remained for him to call upon the meeting to do that which he was sure they would do most cheerfully —that was to pass a vote of thanks to Mr. Winkworth for his highly interesting paper. It was a paper full of facts, which were put together in a clear, consecutive, and logical form; and it was a paper which was calculated to produce a great amount of good.

Mr. WINKWORTH said that he could confirm the testimony borne by the chairman, to the obloquy Mr. Dillon had to encounter in his early efforts, under the signature of "Delta," in the *Times*, to imbue the manufacturing mind with a sense of what was due to the improved intelligence of the age. He could also sympathise with that gentleman to a considerable extent; the firm with which he was at that time connected (Bell and Winkworth) in the silk trade, being one of the few who ventured to embark on the crusade of free trade. He also agreed with Mr. Dillon, that perhaps too much stress was laid upon the supposed importance of the fancy branch of this manufacture. The goods in and around the room were introduced rather as specimens of what could be done in rich figured silks; but, unquestionably, the great consumption of this country was of middle and lower qualities, in which there was little or no scope for the display of taste. With respect, however, to "cheap" goods, he (Mr. Winkworth) was still of opinion that the demand for them did lead to the introduction of spurious or inferior materials, an opinion which a subsequent speaker had too fully confirmed. In fact, "cheap" goods were generally dear goods, and no one would be more ready to admit this than Mr. Dillon himself, and to deny that the important firm with which he was connected ever sold other than really cheap goods, whether of a ribbon at a penny a yard or the richest brocade at a guinea. With the observations of Mr. Wilson he generally concurred, and thought the narrative with which he had favoured the meeting, of the introduction of the jacquard loom to this country, very interesting. The silk trade of this country did not, however, take its rise from the revocation of the edict of Nantes, as it had a recognised existence in this country as early as the fourteenth century; but the arrival of so many refugees on that occasion, certainly gave it an impulse, which, however, they subsequently took some pains to restrain. It was a remarkable fact that soon after their settlement in this country they actually obtained a patent, and ultimately an Act of Parliament, confining the manufacture of "Lustring and *à la modes*" to themselves, as distinguished from the English weavers, by prohibiting their importation. To Mr. Lewis and Mr. Graham, his thanks were due for the light they had thrown on the points to which they had severally addressed themselves. As regarded Mr. Bray, of Coventry, that gentleman would hardly expect that he would indorse all that he had advanced respecting the assumed difference of taste, and ability for originating novelty in design, and the physical, or he might rather say the metaphysical, way in which he had accounted for it. Mr. Webster, however, who was an excellent authority on all that belonged to the ribbon branch, had left him nothing further to say upon it. To Mr. Walters he had to tender his thanks for the explanations with which he had accompanied the splendid display of furniture silks of his manufacture which graced the room. He had only, in conclusion, to say that, with every disposition to do justice to native industry, he had no special case to make out, being of opinion that people ought, and certainly would, always buy in the cheapest and best market, whether of home or foreign production; and to thank his brother members for the candid reception they had given to his paper, and his friend in the chair for the courteous way in which he had originated and conveyed the vote of thanks which had just been passed.

The Secretary announced that the Paper to be read on the evening of Wednesday next, the 28th instant, was "The History and Present State of the Machine-wrought Lace Trade," by Mr. W. Felkin, F.L.S.

Since the meeting, the SECRETARY has received the following letter from

Mr. JAMES VAVASSEUR, in which he says:—

"The discussion was too well sustained last evening to admit of any remarks from me on Mr. Winkworth's paper; I shall, therefore, be obliged if you will allow space for a few lines in the *Journal*, if it can be spared.

"I do not know whether it is allowed to criticise the paper, but it suggested to my mind a speech from the throne, raising expectations by its title, which it did not satisfy by its matter. Its chief merit was in its being calculated to allay the fears of our silk manufacturers, if any troubled them. I heard the paper read with much pleasure, for its style was pervaded by a certain air of good taste, which seldom fails to please, even when it does not inform or convince.

"The paper would have effected more good if it had been less encouraging and more rousing. Mr. Winkworth congratulates the silk manufacturers of this country, that British goods are sometimes sold as French. I shall think it a much greater triumph when, to facilitate the sale of French goods, shopkeepers shall find it desirable to call them British. When we have reversed the figures of imports and exports, I shall think there is some ground for congratulation. That is to say, when we export two and a half million of silk goods, instead of importing that amount; and when we do not import more than one and a half million.

"The Exhibitions of 1851 and 1855 have done this good for the British silk manufacturers—they have created an appreciation of the real position of their fabrics as compared with those of France.

"This was apparent in the discussion, when free and frank acknowledgment was made to French superiority. This is a hopeful sign, and betokens the right state of mind, from which improvement may be predicted. It will always be impossible for a manufacture to improve when those engaged in it fancy they do well enough already that there is no goal beyond to reach. I fully agree with the chairman, who after all pointed out the chief weakness to be remedied, when he said that the superiority of the French fabrics is to be referred to the superior intelligence of the workmen. I do not mean to say, that English weavers are not intelligent, but intelligence is to be reckoned relatively, and it would be absurd not to allow the superior intelligence of the French weaver. The fact is confirmed by his execution of difficult works, not in small quantities, or as pieces for show or curiosity, but as the staple of a province.

"There is a class of goods, for which the French draw all the world to their market, which owe their excellence to the intelligence of their workmen. Till our workmen are raised by careful education to the same rank of intelligence as the French, we cannot expect to reverse the figures of exports and imports before alluded to. We may glut all markets with our plain goods, but till a special as well as general education is afforded to our weavers to qualify them for their work, the French goods will still keep their deserved place in the esteem of all buyers of taste and refinement. I am convinced that the general education of the people, together with the special education of our industrial classes, has a most important bearing on the commerce of the country. There are some things which every person in the nation should not be ignorant of, there are other things which a few only need know, but it is indispensable that those few should know them.

"Of the morality of our weavers, as regards *meum* and *tuum*, I cannot speak very highly. The great value of the material entrusted to them excites the cupidity of unprincipled receivers, who offer temptations and facilities for pilfering, which have undermined the honesty of men, women, and children; while the weavers themselves get little by their dishonesty, the corrupt receiver fattens on the gains of their robbery. The manufacturers might be able to prevent much of this loss if a bobbin could be devised to meet certain conditions. The bobbins chiefly in use are of wood, which can easily be made heavier in many ways, silk being abstracted equal to the increased weight of the bobbin. Ingenuity, worthy a better cause, has been expended to defraud employers in this way. To remedy these evils, some manufacturers have tried metal bobbins. As they would be too heavy, if made solid, they have been made hollow, to ensure lightness, and have, therefore, afforded a chance for roguery to fill the hollow with sand.

"A great benefit would be conferred on silk manufacturers, as affording them the means of detecting and preventing fraud by their workmen, if a bobbin could be devised to meet the following conditions:—

"1. Exact uniformity of weight.

"2. They should be made of a material that could not be made heavier without instant discovery.

"3. They should be made of a material which would not absorb damp from the atmosphere.

"4. They should be made of a material not likely to affect the colour of silk wound on them.

"Most of these conditions would be met by porcelain, but its advantages would, I think, be neutralized by its liability to chip, thus exposing sharp angles, which would cut the threads wound from such bobbins. It is only by making known our wants that we can expect to have them supplied; perhaps the ingenuity of some of the numerous readers of your *Journal* may be directed to meet our wants. If so, I think I may venture to say that the inventor would meet with a sale sufficient to repay him for his outlay and reward him for his trouble.

"There is one observation I must still make, although I have already written too much, that is, that notwithstanding all the efforts of the Society to foster Schools of Design, the silk manufacturers are, for the most part, dependent on Frenchmen for their patterns. Another want of the trade is a court of appeal in case of dispute between master and workman, similar to the Conseils des Prud-'hommes, at Lyons.

"To return to the discussion, the speech of Mr. Wilson was interesting, but not to the point; it referred to the past, not to the present. If the Coventry gentleman is to be believed, the British are prevented, by want of certain bumps on their crania, from equalling the French; if so, we had better give up the attempt at once, and save ourselves further trouble. But, as I see nothing in French excellence that may not be attained by ourselves, if we apply suitable means, I am not disposed to feel discouraged. To do justice to the Coventry gentleman, his type of British self-esteem was very well illustrated by the succeeding speaker."

EXAMINATION OF STUDENTS OF CLASSES IN INSTITUTES.

To the deputation which waited upon the Duke of Argyll, the Postmaster-General, his Grace has replied to the effect, that he is not prepared to place at the disposal of the Council any situations in the Post office to be competed for as prizes in the forthcoming examination; but that he will be disposed to look favourably on the claims of any parties who may be recommended to him by the Council as having passed their examination with credit.

On this subject, the Secretary has received the following letter, without signature or address:—

"I beg leave to offer you a prize for the approximate solution of equations, as a subject having some claim to form a part of the mathematical portion of your projected examinations. It is true that in practice the necessity for the actual calculation of roots rarely occurs, but the theory of equations is so intimately connected with every important branch of the mathematics, that it can hardly be deemed sufficient to study its general principles without applying them to numerous particular examples. Besides, the process of approximation is founded on the same principles as the differential calculus, without being encumbered with those metaphysical difficulties which cause the results of that calculus to be received with very imperfect faith, even by the most intelligent students. A simple form of calculation, by which the values of real roots, and the critical values which indicate impossible pairs of roots, may, in all cases, be easily determined, is to be found in many modern books, but as, with the exception of an article in the "Penny Cyclopædia," I have not found many examples of the complete discussion of equations, I have written down the first figures of the roots, or critical values, of all the equations in De Morgan's Arithmetic. Accept my best wishes for the success of your important undertaking."

With the letter were received the halves of two £5 Bank of England notes.

PATENT OFFICE PUBLICATIONS.

In a recent number of the *Commissioners of Patents' Journal*, it was stated that the Commissioners' donation of official works had been transmitted to the following cities and towns:—Aberdeen, Accrington, Beverley, Birmingham, Bolton-le-Moors, Bradford, Brighton, Bristol, Bromley, Cambridge, Canterbury, Carlisle, Cork, Dublin, Gateshead, Glasgow, Great Grimsby, Hertford, Huddersfield, Hull, Ipswich, Keighley, Kidderminster, Leeds, Leicester, Liverpool, Wolverton, Crewe, Macclesfield, Gorton, Manchester, Newark-upon-Trent, Nottingham, Oxford, Plymouth, Newcastle-upon-Tyne, Newport (Monmouth), Preston, Reading, Rochdale, Rotherham, Sheffield, Shrewsbury, Southampton, Stirling, Stockport, Warrington, Waterford, Wolverhampton, Yarmouth, Wednesbury.

As it is generally believed that these grants have been hitherto limited to Free Libraries, and as it is evident that such libraries exist in but a small number of the cities and towns named, the Secretary has made it his business to ascertain the exact terms on which the donations are made. He is informed that "in the case of every one of the towns and cities named in the *Journal*, the Commissioners' donation has either been placed in a free library already existing, or has led to the formation of one for its reception. The latter has been the rule—the former the rare exception. Where a corporation exists, the donation is made to that body; where none exists, then to the magistracy, or some local parliamentary board; but always on condition of the works being rendered daily accessible to the public free of charge. Where the donees are unable immediately to provide accommodation for the works, they are at liberty to arrange with a Mechanics' or other Institute for the temporary custody of the donation; the depositary, of course, undertaking to fulfil the original conditions of presentation."

These conditions are:—That a librarian shall be appointed to take charge of the works, who shall be held answerable for their safety and condition; that the works must be deposited in a public free library, and be open to the inspection of the public daily, and at all reasonable hours; that no charge is to be made, or fee of any kind taken, on any pretence whatsoever, for the inspection, reading, or taking notes from any of the works; and that no works be lent to any person, or removed from the library, except for binding or necessary repairs.

As the Commissioners only present their works to public responsible bodies, it remains for Mechanics' Institutes to urge the local authorities to apply for the donation, they at the same time volunteering, if desirable, to undertake its present custody.

Mr. John Plant, the Curator of the Royal Museum and Library, Salford, in a letter to Mr. Alderman Langworthy, the chairman of the committee, says that the set of Specifications of Patents presented by the Honourable the Commissioners has been numerically arranged, and bound in 410 volumes. During the eleven months they have been in use, the majority of persons who have consulted them have been working mechanics, foremen, managers, and overlookers of firms. Others have been inventors and patentees, anxious to examine the claims of existing correlative patents, so as to avoid infringement of patent rights; and others, perhaps the smallest class, those interested in the general progress of the mechanical arts and of science, examine the whole of the patents as they are received at the library. The monthly issues have averaged 253 in number. The references have principally been to those patents relating to "improvements in the working power of engines," to those for spinning and weaving, and to those for dressing fibres of cotton, wool, and silk.

Home Correspondence.

REMARKS ON MR. WHYTOCK'S PAPER ON THE CARPET MANUFACTURE.

SIR,—I did not see the number of the *Journal of the Society of Arts* of the 22nd of February, containing an article on the carpet manufacture, by Mr. A. Whytock, until the other day; and although a portion of it, regarding my loom, was, I see, ably answered at the time by Mr. J. Burch, yet I beg to be permitted to offer a few remarks. I have no doubt many carpet manufacturers have felt seriously the introduction of mechanical power to take the place of the old system of hand labour; but still I think any statement made should be tempered by truth. Mr. A. Whytock, in speaking of my power loom, says:—"That of Mr. Sievier is an ATTEMPT to knock up a *Brussels* pile without the use of the wire, *but only* APPLICABLE to the weaving of one *layer of white* and plain worsted warp, presenting a surface afterwards to receive its pattern from the printing of blocks." So far from my loom being only an *attempt* to beat up a pile, Mr. Burch states that he has printed nearly four million yards with it; and to his able statement I beg to refer your readers. As to the loom being "only applicable to the weaving of *one layer* of white and plain worsted warp," I think it would not have been a very great stretch of Mr. Whytock's imagination to know that it was immaterial whether the warp was coloured, or patterned, or white. He might as well say, if he had only seen a needle sewing white thread, that it would not sew black. I beg to acquaint him that my loom will and has woven fine framed carpets at an average rate of twenty-five yards daily; and also that it does weave the printed warps, and fine tapestry for curtains, and covering for sofas, &c., giving eighteen to twenty terrys or loops to the inch, and will weave forty if requisite. It weaves also coach lace. Licenses are let to Messrs. Christy, the eminent manufacturers of Fairfield, Lancashire, whereby the loom weaves Turkish towels, knotted counterpanes, &c. Therefore, so much in answer to its being an "attempt," and weaving only a "plain fabric."

The loom was the first that was ever brought into practical use, and caused a great revolution in carpet weaving, rendering carpets cheap for the million; which has been well carried out by Messrs. Bright, of Manchester, who are always wishing to add comforts to the humble, as well as luxuries to the rich, by a better production. Previous to the introduction of my power loom, 1s. 3d. was paid to the weaver for weaving a yard of cut pile carpet; by the patent loom, the weaver earns better wages at one penny, which is the *sum paid*, thus saving 1s. 2d. a yard. The ordinary Brussels carpet costs seven-eighths of a penny when woven by the power loom, but by hand it used to cost 1s. A greater saving is made in finer articles—indeed, to an extent of 2s. 6d. per yard.

Since the period of the invention, other ingenious looms have made their appearance; but they use a wire to elevate the pile or loop. They are necessarily complicated and expensive, and more likely to get out of order. I am not saying this in disparagement of any brother inventor, as my patent prevented them from using their ingenuity to weave without the aid of a wire,—a wire having always been before necessary in the manufacture of Brussels or piled goods.

I am, &c.,
R. W. SIEVIER, F.R.S.

Old Manor House, Holloway, May 10, 1856.

TONNAGE REGISTRATION.

SIR,—In the *Journal of the Society of Arts* of Friday last, I observe a letter by Mr. Atherton, addressed originally to myself, and published in the *Mechanics' Magazine* on the same day, with certain explanatory remarks appended to it. As it is important that the readers of the letter should be acquainted with at least a portion of those remarks, I shall feel obliged if you will give place in your next number to the following extracts from them:—

"The typographical errors in our note on tonnage admeasurement, in No. 1707, which were inserted in No. 1708, are not, after all, of much importance, and we are unable to discover any further error in the enunciation of Sterling's rule, except that in the 11th line, on page 393, which runs across the page, instead of a_{n+1}, should be read a_{2n+1}—an error which we are convinced would not cause much, if any, inconvenience to the intelligent reader. We have, in our anxiety to keep this note within moderate bounds, (space in our columns being at present in great demand) so far erred in the latter part of it, that we have called that the "curve of sections" which ought to be called the "scale of displacement." The former of the two curves there represented is the curve of sections, and the latter the scale of displacement. However, these two curves have little or nothing to do with the main object of the note. We do not think these errors of sufficient importance to warrant our reprinting the whole note, with its several formulæ, as Mr. Atherton suggests.

"The request that we should introduce textually the rule for calculating tonnage, as deduced from this formula, and legalized by the Merchant Shipping Act of 1854, is, in our opinion, unreasonable. Mr. Atherton, in an elaborate attack upon this rule and other provisions of the Act in question, before the Society of Arts on the 16th of January, contented himself with a *mere reference* to the objects of his attack, in which course he was doubtless justified, as the persons interested in these matters are of course acquainted with their leading features.

Justice and good faith rather point out the *assailant* as the person on whom the onus of placing fairly before the public the objects of his attack should fall, than those who merely concern themselves in their defence. * * * In conclusion, we must remind Mr. Atherton that our criticism on his paper on tonnage appears in a *review*, and not in the communication of a correspondent, as he, altogether without reason, intimates; and we are, of course, responsible for that review."

You will perhaps permit me to add that the errors which have given rise to this correspondence are but few, and, as they are chiefly typographical, have no actual bearing upon the criticism preceding the "note" in which they occur. They appeared in consequence of the article being deprived, through an accidental circumstance, of final editorial correction. Those who have had to do with the revision of printed mathematical papers know how difficult it is to secure typographical accuracy in them, even under favourable circumstances, and will not be disposed to over rate the importance of an evident misprint when such occurs.

I am, Sir, your obedient servant,
THE EDITOR OF THE *MECHANICS' MAGAZINE.*

166, Fleet-street, London,
May 19, 1856.

THE DISCUSSION ON DR. CLARK'S PAPER ON THE WATER QUESTION.

SIR,—In your report of last week's discussion on Dr. Clark's paper, I am represented to have said (in reference to certain waters, the healthiness of which I was comparing) that "the difference between the two waters in question was *only* that one of them contained a large admixture of town-drainage."

For the word "only," in this sentence (p. 440, col. 1, line 2), the word "chiefly" should be substituted; for, although that was, I believe, the *only essential* difference between the two waters, there was a further difference in their saline ingredients, due to the fact that the water polluted by urban drainage was likewise rendered somewhat brackish at each rising of the tide.

I am, &c.,
JOHN SIMON.

REMARKS ON PROFESSOR CLARK'S PAPER, ON MEANS AVAILABLE TO THE METROPOLIS AND OTHER PLACES FOR THE SUPPLY OF WATER FREE FROM HARDNESS AND FROM ORGANIC IMPURITY.

SIR,—Upon the discussion of the above paper read last Wednesday before this Society, Mr. Frederick Braithwaite introduced a table of analyses of different waters, and made some remarks upon the chemists whose results, he said, they were. As many persons may be apt to be misled by the analyses given in this table, and also by the remarks upon them made by Mr. Braithwaite, I think it necessary that I should offer a few observations upon the subject.

In the first place, I would direct attention to the fact that the table contains the analyses of all sorts of waters, as the heading shows, and yet Mr. Braithwaite in discussing the subject, would lead persons to class them as one kind of water only, for immediately following the table of analyses, he says, "The above table showed the results of the analyses of the so-called chalk water made by different chemists, and all differing in their results."

I may state, that by the "so-called chalk water," Mr. Braithwaite means water from the deep wells in the chalk strata under London, and of these deep wells there are many, and at different depths into the chalk, and no two wells contain water of exactly similar composition. The proximity in composition I have ascertained, however, to be regulated a good deal by the proximity of depth from which the water is drawn from the strata. I shall allude to this afterwards.

The water in this strata is peculiar in containing carbonate and sulphate of soda in considerable quantities, together with chloride of sodium, better known to most persons, perhaps, as common salt, and these three salts form about six-sevenths of the whole of the solid matter remaining when the water is evaporated in a vessel to dryness, whilst the other one-seventh is composed of the other ordinary salts generally met with in water for domestic use.

The peculiarity of the water having so much soda salts in its composition, led a few persons, and amongst the number Mr. Frederick Braithwaite, to maintain most strenuously, on more than one occasion, that the water of these wells was a mixture of upper chalk water with sea water; in fact, that the sea percolated through the chalk into those wells, and the soda salts could come into the water in no other way than from the sea. When Mr. Braithwaite has been opposed in this view—it being chemically impossible out of any admixture of sea water and upper chalk water, to make the deep well water—he has, on more than one occasion, tried to fortify this false position by stating, that, whatever chemists may say, he is right; and as a further proof that he is so, he asserts that the salts of soda are increasing in the deep wells, and that these are supplied from no other source than the sea. In proof of this increase, he has quoted Mr. Brande's analysis of the Trafalgar-square water in 1846, against Messrs. Abel and Rowney's, made upon the same water in 1847. (See *Quarterly Journal of Chemical Society*, vol. i. p. 97.) This latter is the analysis in Mr. Braithwaite's table under the heading "College, 1850." In Mr. Brande's analysis there are more soda salts, but in Messrs. Abel and Rowney's the total saline constituents are slightly greater, and upon this one result alone, a negative one, has Mr. Braithwaite maintained that the salts are increasing in the deep wells under London, and that the source of supply is the sea.

Although I had made many analyses of waters from the deep wells, and some as early as 1844, I did not examine the water in the Trafalgar-square well until 1850, and I then found it to contain, including volatile or organic matter, 61·60 grs. per gallon of solid matter, being a decrease of several grains per gallon from the time when it was examined by Mr. Brande and Messrs. Abel and Rowney. I have examined it repeatedly since, and find a gradual decrease, although it goes on more slowly than at first. My last analysis was made upon the water of July and August, last year, and the solid contents of a gallon at 60° F. were 58·85 grs., being a decrease of upwards of 9 grs. since 1847.

I have not confined my experiments to this well alone, but have examined water from chalk wells in different localities in London, and with the same general result. Hence the difference between Messrs. Abel and Rowney's and my analysis.

In making these experiments, I was led to observe that, as a rule, the shallower the well is in the chalk under London, the less solid matter does the water contain; a fact against the infiltration of sea-water into these wells; for the nearer the wells are to the surface, the nearer they are to the sea, and they would be liable to a larger amount of sea-water, and consequently a greater amount of solid matter, and not a lesser, as I have found them to contain.

Under the joint head of Campbell and Clark, in the table supplied by Mr. Braithwaite, is given, first, my analysis of the Trafalgar-square well water, which is extracted from a paper published in the last number of the *Quarterly Journal of the Chemical Society*, and which I read before that Society, "On the Source of the Water of the Deep Wells under London," and the next analysis is said to be Dr. Clark's. Now this is somewhat curious, as Dr. Clark told me, last year, that he had never analysed it, and I know he has not done so since. Indeed, if you turn to the discussion upon Mr. Homersham's paper "On the Chalk Strata considered as a Source for the Supply of Water to the Metropolis," which was read before this Society on the 31st January, 1855, you will notice that Dr. Clark, when speaking of the deep well water, in reply to some statement of Mr. Braithwaite's about the water containing 100 grs. of salt per gallon, says, "He had a friend sitting near him who told him he had accurately examined these waters, and it was no such thing; and, moreover, that a very small portion of salt was present." (See *Journal of the Society of Arts*, vol. iii., p. 180.) Dr. Clark, quoting from a friend as to the quality of this water, is rather a strong proof that he had no data of his own up to that time to go upon, and I am sure that he has not analysed it since.

But I have only to call attention to the analysis quoted by Mr. Braithwaite as Dr. Clark's; and to ask is it likely that such an analysis could be made by Dr. Clark? For Dr. Clark is a chemist, and no chemist ever found the soda salts in the estimated solid matter as *bicarbonate* of soda; and if Dr. Clark really found 51·3 grs. of sulphate of magnesia (?) in a gallon of water, and only 28·5 of bicarbonate of soda (?), do you think he would say, as Mr. Braithwaite makes him say, namely, that "he found 79 grs. of solid matter to the gallon, consisting principally of soda salts?"

Mr. Braithwaite may confound magnesia salts with soda salts, or do as he likes to make statements suit any theories he may please, but chemists, and I hope the world generally, appreciate Dr. Clark's scientific acquirements too well, and know better than to believe it was possible for him to make such egregious mistakes.

I am truly of opinion that if analyses are extracted from different works, and tabulated for introduction in others, they should be done so with accuracy, and should not be mutilated to be made more suitable for any purpose, at least without a notice that certain things have been left out or certain things changed for others. I am conversant with the greater number of the analyses in the table given by Mr. Braithwaite, and nearly all have been subjected to mutilation or change, my own among the number.

Before concluding these few remarks I would just observe, that Mr. Braithwaite is perfectly wrong in stating that the deep well waters contain no carbonate of lime. There is not one well under London but what does, and there is not one but what shows hardness by the soap test. As I stated on a Committee upon the River Lea Trust Bill, in Commons and Lords, in 1850, the Trafalgar-square water was 5·3 degrees hardness. The water in July and August last year was slightly less hard, being 5·11 degrees. I am sure if Mr. Braithwaite would experiment himself, instead of culling portions of analyses here and there, and speculating upon them when reduced to a tabulated form without any data of how they are obtained, he himself would neither differ so widely from chemists as he now does, nor would he find chemists to differ so widely from themselves as he states.

I am, yours, &c.,
DUGALD CAMPBELL,
Analytical Chemist to the Brompton Hospital.
7, Quality-court, Chancery-lane, May 21, 1856.

Proceedings of Institutions.

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YORKSHIRE UNION OF MECHANICS' INSTITUTES.—The nineteenth annual meeting of this Union was held at Middlesborough-on-Tees, on Wednesday in last week, under the presidency of Edward Baines, Esq., the president of the Union; followed by a *soirée*, at which Lord Harry Vane, M.P., took the chair. At the meeting in the morning, delegates attended from the following places:—Batley, Bradford, Bramley, Brighouse, Call-lane, Calverley, Darlington, Eccleshill, Farsley, Gomersal, Grassington, Halifax, Hebden Bridge, Helmsley, Holbeck, Holmfirth, Huddersfield, Leeds, Lockwood, Malzeard, Masham, Middlesbro', Northallerton, Plufforth, Richmond, Ripon, Rotherham, Scarborough, Stockton, Wakefield, Wentworth, Woodhouse, and York. There were also present many of the members and officers of the central committee of the Union, Mr. W. H. M. Blews, Midland Counties Union, and the Rev. Dr. Booth, F.R.S., Chairman of the Council of the Society of Arts, besides other gentlemen. The proceedings having been opened by the president, it was moved by Mr. Curzon (Huddersfield), and seconded by Mr. Hixon (Holmfirth), that Mr. T. Dawson (Leeds) be appointed auditor of the accounts of the Union. Mr. James Hole, honorary secretary, then read the report of the committee of the Union, of which the following is an abstract:—

The report commenced by adverting to the appointment of Mr. Barnett Blake as agent and lecturer to the Union, and stated that since the commencement of his labours on the 3rd of March last, he had made 17 visits to the Institutes, as follows:—11 lectures, 2 *soirees*, and 4 conferences. It then expressed the hope of the committee that, during the next winter, they should have the cordial and practical support of the Institutes in carrying into effect the topographical arrangement of the agent's visits, sanctioned at the last meeting of the Union, so that the expense of his visits might be lessened and his time saved. It next spoke in grateful terms of the substantial assistance which Lord Ashburton had signified his intention of affording to the Union. In speaking of the operations of the village library, it was observed that an important element in the success of the library plan would be secured if some arrangement could be accomplished by which lectures could, from time to time, be delivered in the villages. On this point the opinion of the Hon. and Rev. S. Best, as given in his lecture on village libraries, delivered at the Society of Arts Educational Exhibition, was quoted. As one method of doing something in this direction, reference was made to a very valuable adjunct recently introduced by the Lancashire and Cheshire Union. This was the introduction of the magic lantern. By its aid the leading facts of astronomy, physical geography, botany, natural history, and other branches of science, with the remarkable cities and renowned places of the world, could be exhibited in an attractive form. Last year, and during the previous two or three years, a list of gentlemen who had consented to give gratuitous lectures (their travelling expenses being paid by the Institution receiving the lecture) at Institutions in their own neighbourhood, was published. The report of last year contained the names of 74 gentlemen. The Committee believed that the Institutions might derive much greater benefit from this part of the Report, if the respective Secretaries were to furnish yearly a list of all the gentlemen in their own neighbourhood able or likely to assist in this good work. The financial position of the Union, though better than last year, was stated to be still eminently unsatisfactory. The balance due to the Treasurer, W. B. Denison, Esq., was about £20. An additional income of £100 per year was stated to be required, to enable an apparatus like the one in use in Lancashire and Cheshire to be provided; to print a catalogue of the Village Library; and to extinguish a small debt for the purchase of books for the library. The first cost of printing a new Manual for Mechanics' Institutes, including a priced catalogue of books for Institution libraries (now about ready), had also to be met, though ultimately the expense might be repaid by the sale of the work. From the returns which had been sent from the Institutes, the following summary was presented:—

Number of Institutes in the Union . . .		130
Number of Members reported in 75 Institutes—		
Males	14,283	
Females	1,180	— 15,463
Annual income of 75 Institutes		£8,154
Number of Volumes in the Libraries of 78 Institutes		93,768
Number of issues of Books in 78 Institutes . .		292,140
Average number of times each Book has been issued		3·1
Number of Books added during the year to 68 Institutes		5,198
(Being an increase of 6 per cent.)		
Number of Periodicals taken in 71 Institutes:—		
Weekly	179	
Monthly	490	
Quarterly	79	—748
Newspapers		609
Number of Lectures delivered at 70 Institutes .		694
Of which 126 were paid, and 568 gratuitous, as follows:—		
Scientific . . .	207	
Literary . . .	454	
Musical . . .	33	—694
In 49 Institutes, containing 13,158 Members, the number of Pupils in Classes		4,984

61 Institutes, having 12,460 members, were situated in places having an aggregate population of 555,702, so that one in every 44 inhabitants of those places was a member of a Mechanics' Institute. On a comparison being made between the years 1855 and 1856, it appeared that there had been an increase in the number of members of 1·5 per cent.; of income of 4·3 per cent.; of lectures of 10·4 per cent.; of books of 6 per cent.; of issues, 0·7 per cent.; and in the pupils in the classes to the extent of 49·8. The only decrease was in the number of female members, which in 46 Institutions seemed to have declined about 10 per cent. The report then went on to say, that "the most gratifying fact brought out by these comparisons is, the one showing that in thirty-two Institutes, the number of pupils receiving class instruction has increased nearly 50 per cent. We trust that the managers of every Institution will, without sacrificing any other department, keep this, the principle one, constantly in view. If the classes do not succeed, it is their duty to strictly scrutinize the cause, and to devote their whole energies to its removal. * * * * If the Mechanics' Institutions are to rise to the position of People's Colleges, and play a worthy part in the educational and social agencies of the nation, nay, even if they are to maintain their present status, and to increase in numbers with the increase of population, though they ought to increase much faster than this, it can only be by becoming educational." This argument, it was observed, became still more imperative, when measured by the exigencies of social life and of productive industry. "As one method of improving the educational organisation of these Institutes, your Committee refer with pleasure to the scheme of examination recently propounded by the Society of Arts, for the members of these Institutions." Not the least hopeful feature of the proposed plan was the fact that 400 of the largest firms in the three kingdoms had declared that they would regard certificates so obtained as testimonials worthy of credit; and it was hoped that the employers in every town would show their sympathy with the cause. If this were done, the scheme would then assume national importance. The report next commented on an important suggestion addressed by the President of the Union to working men, which was "that a canvassing and visiting committee, composed chiefly of working men, and with a considerable proportion of young men, shall be formed every year in every Mechanics' Institution, whose duty shall be, within the first two months of the winter, October and November, to canvass the whole population, and to bring in the greatest possible number of members to the institution." Among the reports from the Institutes, that from Huddersfield was as instructive as usual. Masham reported the erection of a "model institution" at a cost of £700, in memory of their late president, the Rev. Thomas Riddell. At the Leeds Mechanics' Institute there had been a novelty in the shape of a Penny Exhibition of the Fine Arts, to which upwards of 20,000 persons were admitted. The Rotherham and Masbro' Institute had also had a very successful Fine Art Exhibition. The Keighley Institute has been presented by her Majesty's Commissioners of Patents with copies of all the published Specifications and Indexes of Patents, and is providing for their accommodation at an outlay of £60. "The Institutes would do well to secure the custody of these documents for the public use, wherever practicable. The Hallamshire Institution reports that the substitution of efficient paid teachers for gratuitous ones has caused a considerable increase of students in attendance at the classes." One novel method of obtaining new members has been adopted in this Institute, viz., giving prizes to those students who introduced the greatest number of new pupils.

Mr. Hole next read the report of the Treasurer (W. B. Denison, Esq.), which showed a balance due to the Treasurer of £21 3s. 3d. The deficiency last year was £68 19s. 5d.; so that the funds of the Union are more satisfactory than at the last anniversary meeting. Mr. Isaiah Dixon (Hon. Sec.) then read the report of the Itinerating Village Library, which stated that, owing to some difficulty in the practical working of the libraries—mainly caused by the want of some means by which the books contained in them could be made known—the number of stations had been reduced from 24 to 11. The issue books of the different stations show that the average circulation for five months of 50 volumes was 197, so that each book was read, on the average, four times. In three instances the libraries had led to the formation of Mechanics' Institutes. With regard to the financial position of the Library, it appeared that last year there was a balance against it of £43, which had since been reduced by £15. Mr. F. Mewburn (Chief Bailiff of Darlington) moved, and Mr. John Crossley (Halifax) seconded, the adoption of the report, which was carried. —The President, at this stage of the proceedings, announced that he had received a letter from Lord Ashburton, regretting his inability, from ill-health, to attend the meeting, and enclosing a cheque for £100, to be applied, if thought fit, to the extension of class instruction. The President explained that the original view of Lord Ashburton was to induce Dr. Hodgson to come and lecture at the Mechanics' Institutions of the Union, upon common and practical things, but, most unfortunately, Dr. Hodgson's health had given way, and he was unable to accomplish this object. Mr. Thos. Wilson proposed, and the Mayor of Ripon seconded, a vote of thanks to his lordship, which was carried by acclamation. The following Institutes were then admitted into the Yorkshire Union:—Normanton Railway Library and Mechanics' Institute, Hepworth Mechanics' Institute, Bentham Mechanics' Institute, Lofthouse Mental Improvement Society, Swanland Mutual Improvement Association, Woodside (Horsforth) Mechanics' Institute. The Central Committee for the next year having been appointed, it was agreed that the twentieth annual meeting should be held at Huddersfield, the numbers being 23 in favour of that place and 19 for Halifax. Thanks having been voted to the gratuitous lecturers, the meeting proceeded to discuss the first subject set down for discussion, which was, "Increase of the rates of subscription paid by members of Mechanics' Institutions." On this point it was stated that the Stockton-on-Tees Institution had increased its rate of subscription, and gained an accession of members thereby. The shortest period for which subscriptions were received was one quarter. In the Huddersfield Institute it was remarked that it had been found advantageous to take fortnightly payments, and in the case of the Leeds West-end Institute, weekly payments had proved most successful. A resolution was then passed, there being only four dissentients, to the effect that the subscriptions in the Institutions generally were inadequate to fulfil the purposes of the Institutions. The next subject was that of the Society of Arts Examinations, which was fully explained by Dr. Booth, the tone of the delegates assembled being very favourable to the scheme. The expediency of appointing yearly a canvassing committee in each Institution then came under consideration. The President explained that by such a system he believed the number of members might be increased five-fold. The principle had been adopted with success by the central committee of the Union, and by the Institutes at Calverley, Holbeck, and other places. The next topic was, "Improvement of Evening Classes, and the employment of paid teachers." The Rev. Mr. Berstead said, he was afraid that the Mechanics' Institutions were likely to be deprived of the services of some of their best paid teachers, especially in villages, viz., the certificated schoolmasters and schoolmistresses. He suggested that a memorial should be presented to the Committee of Council on Education on the subject, but this, it was explained, was beyond the limits of the present discussion. The last subject was, "The establishment of classes for the instruction of females in needlework and plain dressmaking;" but this was not discussed, owing to want of time. Lord Harry Vane, M.P., proposed, and the Rev. H. B. Bower seconded, a vote of thanks to the President, which was carried by acclamation. During the day Lord Vane presented £10 to the funds of the Union.—The delegates then adjourned to dinner, which was attended by about 100 gentlemen, the chair being filled by Mr. Isaac Wilson. After leaving the dinner table, the company proceeded to the extensive ironworks of Messrs. Bolckow and Vaughan, where they witnessed the tapping of a blast furnace, and the running of the molten metal.—The *soirée* was held in the Odd Fellows' Hall, under the presidency of Lord Harry Vane, who, in his address, marked upon the rapid growth of the town in which they were assembled (Middlesbro'-on-Tees), which he said was due to the enterprise of a great railway company, and to the discovery in its neighbourhood of a bed of ironstone. The town offered an ample field for the exertions of a Mechanics' Institution. He observed that Mechanics' Institutions, properly so called, could only aid the education of the working classes by those classes taking advantage of them, and by the founders of such Institutions taking into consideration the various circumstances of the locality, and the requirements of the particular people for whom they proposed to establish them. He thought that such Institutions should open educational classes, not only for the instruction of the young, but also for teaching those adults whose early education had been neglected—classes, in fact, for elementary instruction—and that the services of competent paid teachers should be engaged. Remarking on the proposed examinations of the Society of Arts, his lordship said, that if this principle were actively carried out, he thought the members of Mechanics' Institutions would see that it behoved them to attempt to attain to those preparatory courses of instruction, without which it would be impossible for them to render themselves equal to competitive examination. The fact of the decrease in the number of females attending the classes, as alluded to in the report, rendered it the more essential that those who thought female education of the highest importance, should press upon all connected with the Institutions the propriety of paying their best attention to this subject.—The Rev. Dr. Booth was then called upon to move the first resolution, which was as follows:—

"That while the necessity of popular education is generally admitted, the instruction imparted at Mechanics' Institutes in those branches of scientific knowledge which are most practically useful, and conducive to social and individual welfare, affords the best proof of the value of such institutions, and their claim to the general and liberal support of the public."

In doing so, he alluded particularly to the subject of female education, urging that efficient classes should be provided in the Institutes for this purpose, so that the female portion of the community might be educated equally as well as the males. The resolution having been seconded by Mr. Newburn, was unanimously adopted. Mr. Ralph Ward Jackson proposed, and the Mayor of Stockton seconded the following resolution, which was carried unanimously:—

"That the Yorkshire Union of Mechanics' Institutes—by affording the benefits of co-operation to many societies; by collecting and diffusing accumulated experience on the most efficient modes of conducting such institutions; by the employment of an agent and lecturer for the purpose of assisting in the organisation, and promoting the successful operation of Mechanics' Institutes; and by the establishment of circulating village libraries, which has proved successful, in the diffusion of English literature of a sound and healthy character for the purposes of instruction and entertainment, and also by the assistance afforded in the establishment of Mechanics' Institutions—has proved its usefulness and efficiency during the last nineteen years, and thereby entitled itself to the warm support of every friend of popular education, whose sympathy in the cause can best be shown by liberal and regular contributions to the Special Agency Fund."

Mr. Edward Baines then rose to propose the next resolution, which was:—

"That the plan of the Society of Arts of London, for examining and granting certificates to the students of classes for adult instruction of Mechanics' Institutes, and other similar bodies in Union with the Society, which has received the approval of a great number of the leading employers throughout the kingdom, by their declaration to regard such certificates as testimonials worthy of credit, is highly appreciated by this meeting, as being one of the best means to give a practical stimulus to the operations of Mechanics' Institutes; and which is still further enhanced by the valuable prizes offered through the medium of the Society to such students as shall pass the best examination in various departments of literature, science, and the arts."

After speaking of the general progress of these Institutions, Mr. Baines remarked that he could not conceive of anyone doubting the use of these examinations. The effect, he said, of these competitive examinations would be to stimulate the best and most effective department of Mechanics' Institutes—the department of instruction in classes. It was by attending the evening classes that those attainments could be acquired by which persons might pass creditably through an examination, and come out with honour to themselves, as showing that they possessed such qualifications as would justify an employer in receiving them into his service. The most useful part of Mechanics' Institutions were their evening classes, where habits of study and assiduity were formed, and a character acquired at the same time. It was by these examinations that the evening classes would be increased, and that a healthy stimulus would be afforded to the young. It would also be a stimulus to the teachers, who liked to see a plenteous harvest follow their exertions. No other body was so well qualified to conduct these examinations as the Society of Arts. The resolution having been seconded by Mr. Joseph Pease, and supported by the Hon. W. E. Duncombe, M.P., was unanimously carried. Other resolutions of a more formal character having been passed, the meeting separated.

MEETINGS FOR THE ENSUING WEEK.

Mon. Geographical, 1. Anniversary.
Tues. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Meteorological, 7 Anniversary.
Med. and Chirurg. 8½.
Civil Engineers, 9, President's Annual Conversazione.
Zoological, 9.
Wed. London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. W. Felkin, "The History and Present State of the Machine-wrought Lace Trade."
Ethnological, 8, Anniversary.
Geological, 8, I. Mr. J. C. Moore, "On the Silurian Rocks of Wigtonshire;" II. Mr. C. Babbage, "On the Influence of Ocean Currents on the Formation of Strata."
Microscopical, 8.
Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.
Fri. Royal Inst., 8½, Dr. Lyon Playfair, "On the Chemical Principles involved in Agricultural Experiments."
Sat. Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Medical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 10th, 15th, 16th, 17th, and 19th May, 1856.

Par. No.
195. Poor Relief (Ireland)—Return.
204. Secretaries of State—Returns.
166. Diplomatic Service—Return.
179. Poor Relief (Scotland)—Return.
218. Sir Charles Hotham—Copy of a Despatch, &c.
220. Police Force, &c., Kilkenny—Returns.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May* 16*th*, 1856.]

Dated 11*th March*, 1856.

588. John Collins, Birmingham—A machine for pulverizing, crushing, pressing, and cleaning land.

Dated 31*st March*, 1856.

774. Gregory Bird, Glasgow—Improvements in the application of asphaltic or bituminous compositions for building and structural purposes.

Dated 19*th April*, 1856.

945. William Crosley, 16, Westbourne-park, and George Goldsmith, Leicester—Improvements in wet gas meters.

Dated 26*th April*, 1856.

999. Thomas Lawes, 32, City-road—Improvements in the construction and manufacture of an implement used in tilling the land.

1001. Malcolm William Hilles, Percy-street, Bedford-square—Improved apparatus, applicable to the treatment and cure of rupture, prolapsus uteri, and other protrusions of the viscera.

1003. Claude Antoine Arnaud, Lyons—Improvements in obtaining motive power from steam and other fluids, and in pumping and forcing water and other fluids. (A communication.)

1005. Alexandre Vacherot, Paris—Improvements in the construction of submarine tunnels.

Dated 28*th April*, 1856.

1007. George Napier, Bath-street, and John Millar, Cavendish-street, Glasgow—Improvements in the manufacture of gas from coal, tar, or other bituminous, resinous, or fatty matter.

1009. Thomas Restell, New Kent-road—Improvements in fittings or appendages for doors, and in the means of fixing or attaching the same.

1011. William Denny Ruck, Topping's-wharf, Tooley-street—Improvement in tanning hides and skins.

Dated 29*th April*, 1856.

1013. John Hick, Bolton-le-Moors—Apparatus for equalizing the temperature of the water in that kind of steam boilers generally called multi-tubular boilers.

1015. Thomas Greenshields, 11, Little Titchfield-street—Improvements in sleepers for railways.

1017. Thomas Webster Rammell, Trafalgar-square—Improvements in pen and pencil holders.

1019. William Pilling, Oldham—Improvement in the treatment of yarns or threads, and in the apparatus connected therewith.

Dated 30*th April*, 1856.

1021. John Smith and William Craven, Collyhurst, near Manchester—Improvements in machinery or apparatus for dressing, machining, and finishing velvets, velveteens, and other fabrics.

1023. Samuel Dyer, Bristol—Improvements in reefing, furling, and setting the sails of ships and vessels.

1025. Louis Jean Baptiste Manevy, Paris—Improvements in manufacturing cast steel.

1027. William Edward Newton, 66, Chancery-lane—Improved method of, and machinery for, polishing the surface of glass, stone, metal, or other materials capable of being polished by friction. (A communication.)

Dated 1*st May*, 1856.

1028. Nathan Defries, Fitzroy-square, and George Henry Bachhoffner, Montague-street—Improvements in gas fires.

1029. Henry Mapple, Childs-hill—Barometers.

1030. William Edward Newton, 66, Chancery-lane—Improved preparation of phosphoric acid. (A communication.)

1031. Claude Perron and Victor Boulland, Paris—Improved knitting machine.

1032. Stephen Carey, Clink-street Wharf, Bankside, Southwark—Improvements in water carts and barrows.

1033. Richard Archibald Brooman, 166, Fleet-street—Improvements in compressing, regulating the pressure and flow of, and conveying gas, parts of which are applicable to air and other fluid pumps. (A communication.)

1034. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for felting or "planking" hat bodies. (A communication.)

1035. Alexander John Paterson, Upper Eaton-street—Improvement in or connected with hawsers and other ropes or chains used in towing vessels.

1036. Nathaniel Smith, Thrapston, Northampton—Improvements in clod-crushing rollers, parts of which are applicable to other descriptions of rollers.

1037. Augustus Smith, Wentworth-street—Treating vegetable fibres, in order to fit them for use as a substitute for bristles in paint and other brushes.

1038. Samuel Hunter, 13, Ravensworth-terrace, Gateshead—Improvement in anchors.

Dated 2*nd May*, 1856.

1039. John Cowley, Quenington, Gloucester—Improvements in the manufacture of paper from straw and other vegetable substances.

1040. Richard Pearcy, Manchester—Improvements in machinery or apparatus for twisting cotton and other fibrous substances.

1041. William Waite, 156, Cheapside—Improvement in the construction of sleepers and rails for railways.

1042. William Naylor, Norwich—Improvements in power hammers and rivetting machines, part of such improvements being applicable to the manufacture of bolts or rivets.

1043. William Day, Campbell-road, Bow-road—Improvements in clod crushers or rollers for ruling, pulverizing, or pressing land.

1044. Alexander Gordon, Fludyer-street, Whitehall—Improvements in evaporating, boiling, and distilling fluids, and generating steam.

1045. Henry Edward Brown, 2, Summer-street North, Dublin—Improvements in the description of hinges denominated concealed hinges, for carriage doors and doors of every description.

1046. Samuel Rooke, Birmingham—Improved manufacture of stair rods.

1047. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for bending or shaping timber. (A communication.)

1048. Henry Atwood Thompson, Lewes—Improvements in haymaking machines.

1049. Robert Tolmie Campbell, Washington, U.S.—Improvements in machines for reaping and mowing. (A communication.)

Dated 3*rd May*, 1856.

1050. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Improvements in electric telegraphs. (A communication.)

1051. John Wright and Thomas Gorrery, Sheffield—Improvements in railway carriage and other springs.

1053. Henry Duncan Preston Cunningham, Gosport—Apparatus to be applied to boats to increase their buoyancy and stability.

1054. Wright Garside, Vicar-street, Kidderminster—Improved method of letting off the worsted or yarn from the bobbins employed in weaving carpets, and other similar fabrics in which bobbins are employed during the manufacture thereof.

Dated 5*th May*, 1856.

1055. Caleb Bloomer, West Bromwich—Improvements in the manufacture of spikes and bolts.

1056. George Williams, 16, Cannon-street, St. George's-in-the-East—Improvements in fog and dark night alarm signals.

1057. William Bulmer and Isaac Sharp, Middlesboro'—Improvements in the manufacture of bricks, tiles, and other articles from plastic substances.

1058. Isaac Holden, St. Denis, near Paris—Improvements in preparing and combing wool and other fibrous substances.

1059. Alfred Chadburn, Sheffield—Improved construction of pressure gauge.

1060. William Gregory, Old Church-street, Paddington—Improvement in the construction of roofing tiles.

Dated 6*th May*, 1856.

1061. Amedée Louis Beudant and Jean Louis Marie Paul Benoit, Paris—Improvements in treating ores of copper containing arsenic and antimony.

1063. John Wright, Upnor, near Rochester—Improvements in apparatus for lowering ships' boats.

1065. William Edward Newton, 66, Chancery-lane—Improved apparatus for connecting boats with their tackle, and clearing or detaching them therefrom when lowered from on board ship into the water. (A communication.)

1067. Thomas Huckvale, Choice-hill, Chipping Norton—Improvements in implements for thinning and hoeing turnips and other crops.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 16*th*, 1856.

2584. William Cooke.
2585. William Eassie.
2596. Joseph Shaw.
2597. George Collier and James William Crossley.
2598. George Collier and James William Crossley.
2601. Josiah Pratt and Thomas Radcliffe.
2602. William Smith.
2604. Richard Archibald Brooman.
2613. Francis Puls.
2618. David Simpson Price and Edward Chambers Nicholson.
2619. David Simpson Price and Edward Chambers Nicholson.
2627. William Munslow and Henry Wallwork.
2649. Jean Lobstein.
2666. Thomas Allan.
2704. Richard Hancock.
2708. William Ward.
2714. George Harrison and William Mitchell, jun.
2756. Frederick Samson Thomas and William Evans Tilley.
2772. Joseph Hacking.
2796. James Cliff.
2872. John Hadden, Henry Hadden, Frederick John Hadden, and Charles Staunton Hadden.
231. Jean Hector Destibeaux.
476. Frederick Kersey.
516. Richard Archibald Brooman.
562. Henry Davis Pochin.
626. Robert Walter Winfield, John Simms, and Thomas Lloyd.
634. George Hills.
656. David Cope.

Sealed May 20*th*, 1856.

2610. John Poole.
2615. Peter Armand le Comte de Fontainemoreau.
2616. Charles Frederick Clark and Manoah Bower.
2631. John Roberts, jun.
2641. Augustus Dacre Lacy.
2657. John Wilkes.
2659. François Coignet.
2695. James Egleson Anderson Gwynne.
2699. Pierre Louis Bergeon.
2713. William Augustus Westley.
2715. David Anderson.
2721. Alexander Watt.
2728. William Hartcliffe.
2913. William Symons.
2917. Richard Archibald Brooman.
2947. William Brown.
61. Edwin Thomas Truman.
93. William Owen.
267. George Hallen Cottam and Henry Richard Cottam.
398. Edmund Leach, James Leach, and Edmund Leach, jun.
521. John Greenwood.
529. Henry Andrew Bower.
621. William Edward Newton.
631. Charles Randolph and John Elder.
639. William Graham.
657. Ely Smith Stott.
677. John Henry Johnson.
706. William Foster.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

April 14*th*.

1545. Henry Goodall.

May 15*th*.

1206. Jean Jacques Joseph Jamin, and Alexander Symons.
1215. John Lee Stevens.
1220. Charles Cowper.
1239. Edward Thornhill Simpson.

May 16*th*.

1262. John Haskett.
1244. William Fulton.
1245. Charles De Bergue.

May 17*th*.

1426. Joseph Westwood and Robert Baillie.

Journal of the Society of Arts.

FRIDAY, MAY 30, 1856.

ANNUAL CONFERENCE AND DINNER.

The Annual Conference of the Representatives from Institutions in Union with the Society is appointed to be held at the Society's house, on Monday, the 23rd of June.

The Annual Dinner will take place at the Crystal Palace, on Tuesday, the 24th of June. The Right Honourable Lord Ashburton, F.R.S., will preside.

Further particulars will be announced in an early number of the *Journal.*

ASSISTANT SECRETARYSHIP.

In the advertising pages of the Journal of this week will be found a statement of the attainments the Council will expect Candidates for this office to possess. The salary will be £200 a-year, with a prospective increase.

TWENTY-FOURTH ORDINARY MEETING.

Thursday, May 28, 1856.

The Twenty-fourth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 28th inst., Henry Cole, Esq., C.B., Vice-President, in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Hunt, James.
Libbis, George.
Mayhew, Charles.
Pinches, Conrad H.
Proctor, Thomas.
Wilson, Edward T.

As a Corresponding Member.
Ward, John.

The paper read was—

THE HISTORY AND PRESENT STATE OF THE MACHINE-WROUGHT LACE TRADE.

By William Felkin, F.L.S.

In fulfilling the duty which I have undertaken, it will be necessary, from the multiplicity of the facts in the series of mechanical inventions and improvements which present themselves in this inquiry, to make a selection of the more important ones. In stating these on my own authority, it is proper to say at the outset, that, in addition to my own personal knowledge, derived from a thirty-six years' close connection with the trade, I have used strict caution in this difficult investigation, so that the truth might be fairly elicited. The facts I shall proceed to state with as much brevity as I can.

Fishing-nets, made by hand, have been used in all ages, and were probably the first articles composed of knotted interstices. Lace has been used for ornament in dress and furniture through all historic time. Netted lace fringes were made by hand amongst the Egyptians, Israelites, Greeks, and Romans. In the middle ages of the Christian era, females in convents, at first, and afterwards domestically, as the favourite employment of ladies of rank and others, used the needle upon plain cloth, to draw aside in various directions the threads of which it was composed. This produced interstices, which were disposed so as to form different patterns. Narrow braidings of suitable textures were also sewn together at different points of their length, so as to form effective designs in lace. Both kinds were often joined together in making up one handkerchief, veil, altar-cloth, or priest's vestment. Almost every variety of interstice or mesh now known was introduced into these lace articles. These kinds of work seem to have prevailed first in Italy, then in Spain, and very soon in Germany, Flanders, France, and England; so that from A.D. 1400 to 1600 they gave profitable employment to the ingenuity and industry of very many females. In 1561, Barbara Uttmann, of St. Annaberg, in Germany, invented the art of making lace, by the twisting, platting, or otherwise weaving threads drawn from spools or bobbins, and passing them round pins. This was done, so as, in the first instance, probably, to produce a series of regular meshes in plain net. But, in due time, cloth-work, open work, and all other requisites of lace—at last including thick threads, or gimping, to give finish and effect to the pattern—were introduced, in the manner now universally employed in making pillow goods. When made plain net, embroidery was put in with a needle, or flowers were attached upon its surface. This new method of making lace, by working on the pillow, quickly superseded the old needle-wrought lace. Becoming known throughout the north of Europe, it speedily made its way from Flanders into England. In both countries, as also in France, schools were established to teach the art. Such a school was set up, in 1626, at Great Marlow; and by 1640 the pillow lace manufacture was greatly extended and well settled in Buckinghamshire. A rivalry was long shown between this country and France in the manufacture of bone or pillow lace; "English point" was equally esteemed with "French point," "d'Alençon," "Valenciennes," "Brussel's point," "Mechlin," wire ground, platted, twisted, or any other. In the early part of the present century, there were one hundred and thirty thousand persons employed in the making of pillow lace in various English counties. At Honiton had been established the production of flowers and sprigs, in imitation of the bouquets and floral ornamentation common in real Brussel's lace, and which were usually sewn upon a plain net three-twist pillow ground. These sprigs, &c., whether Brussels or Honiton, are now ordinarily applied to *machine-wrought* three-twist net.

We have to trace the course whereby the productions of this intricate manual art have been successfully imitated. A series of the different meshes or grounds produced by machinery were placed in the Exhibition of 1851 by one of my sons. These specimens are enlarged to about the size of an inch each mesh, and show, by different coloured threads, the diverse course of each, necessary to the attainment of the required results. Nearly every known mesh—certainly every useful one—has been mechanically produced; and into most of them good, in many, elaborate and tasteful, designs have been introduced. This has been effected by controlling, in the arrangements of the machine, either sets of threads, or, as in the pillow, every individual thread employed in the operation.

The invention of the stocking loom by Lee was one of the most astonishing instances of genius, perseverance, and success, the world ever saw. It was a great stride to take in advance, and that by a clergyman, from three knitting skewers in the fingers of a woman, to a machine so simple in principle, and yet requiring such complicated movements, so multiplied in its parts, and in that age so delicate and difficult of handicraft construction. Yet his ingenuity, and its practical results, as useful as they have become universal, unimpaired in their remote influences by the tale of the neglect he experienced at home, and misfortune which closed his unhappy career abroad, have so filled the thoughts and fired the imaginations of the successors of this great man, who, in the town of Nottingham, have ever since been employed in improving his handiwork, as to sharpen their wits and make cunning their fingers. The skill of the working smiths of that place has been for two centuries a proverb, and has become celebrated far and wide. It is not too much to say, and not unimportant to remark, that the example of Lee's thoughtful, indomitable perseverance, has been followed, even up to the present day, by more surprising results than can fairly be attributed to the influence of almost any other mechanical inventor. This will be seen in the history we hasten to trace out, and in the extent and importance of the manufactures directly or indirectly emanating from the stocking frame, by the inventions of those who were educated in its construction and use. This machinery is now made of so ponderous a kind as to require steam for its moving power, of greatest efficiency; it is composed of many thousand parts; and these of so delicate and nice an adjustment, as that they must be made mathematically true, and turned out of hand with absolute certainty of harmonious working, or they would be useless, if not self-destructive. Whatever, therefore, file and forge, hammer and plane, can effect, is seen in the lace and stocking machinery of the present day. Such has been the reflex influence of adaptations in each trade upon the other, that it can no longer be said with truth, as formerly, that the stocking frame remains unimproved. By late alterations in the latter, they have become fit companions in mechanical excellence.

By Strutt's patent, 1758, for "Derby rib" hosiery, a variation of the uniform or plain looped work of the stocking frame had been shown to be practicable, and might be made extensively applicable. It was effected by shifting one or more loops to the hooks or "needles" beside them, and the result is to make an interstice. The operation was first done by hand, then by an added piece of machinery, and eventually so as to produce a pattern. The lace open work on ladies' ancles and insteps is an example of fancy stockings thus produced. To place a whole row of points in number and situation equal to the number of hooks or needles intended to be operated upon in the stocking frame, and thus by applying them mechanically to these hooks, and removing the loops from them, was the object of Morris's "œillet" or eyelet-hole patent of 1763, perfected in 1781. This invention was at first employed in the fabrication of open work mitts and gloves, and was a great step towards using many of the component parts of the stocking frame in the manufacture of lace. It was pirated, by applying the principle in almost every possible form; but the patent right was sustained. Morris derived a good profit, and the Nottingham lace trade commenced its first epoch of development.

In 1768, Crane, of Edmonton, by applying a kind of warp frame to the stocking loom, made a "vandyke" looped stocking web. The application of "tickler" apparatus to shift loops on this frame, had issued in producing various open works and lace articles; such as so called "Valenciennes," "flowered," and "spider" nets. To this machine may be traced the origin of the present "warp" frame. In the same year, Hammond made some kind of lace upon the stocking frame which he considered bore resemblance to that worn by his wife upon her cap. Dissipated habits seem to have prevented his attaining any practically useful results.

Taking up Morris's patented principle soon afterwards, Arthur Else made such adaptations of machinery in and to the stocking frame, as laid the foundation for the future construction of the "knotted," "twilled," "stump wire," and "mesh" machines. In 1770, or thereabouts, Else and Harvey took from London to Nottingham what was called the "pin" machine. It was extensively used for making lace there; but, from some now unknown cause, it ceased to be employed. Its construction, mode of operation, and first products, are, and have long been, forgotten there. But this machine was soon introduced into France, where, through modifications, it soon became the prolific source of employment and wealth, in the immense production of single and double silk net, at Lyons; and, still later, being obtained by Austria, has issued in their important manufacture of "Vienna" silk net. The "*tulle simple et double de Lyon et de Vienne*" is known and used wherever lace is consumed. Had there been a museum for machinery and its products in London, Nottingham, and other seats of our industry, specimens of this and other now unused and forgotten ingenious combinations would be forthcoming. This has long been a cherished desire on my part and many others, who do not despair of its being realised before long. On several visits to Lyons, thirty years ago, I endeavoured to obtain a sight of this modified machine, as well as the way in which the silk net was dressed; but, contrary to my experience there in the silk manufacture, was always refused. Before 1780, Robert Frost adapted the "tickler" stocking frame, so as to make a "fining," round which thick threads could be worked by the needle, and so produce a pattern. He also made a "square" net from the stocking loom, and, in conjunction with his brother Thomas Frost, took out patents for several of these adaptations. In some of these, an instrument like the barrel of an organ was used for operating upon particular needles or points.

In 1777, either Robert Frost or Holmes—the latter, a workman, who lived and died poor, at Nottingham—discovered the mode of making that lace from the stocking frame, which was afterwards so well known and extensively consumed under the denomination of "point" net. To which the plan belongs is not known; both claimed it—probably each helped the other in bringing it into operation. This "two-course point" net was produced by a single thread passing across the whole course of needles of a very fine guaged stocking frame; the loops thus formed being removed sideways by points operating upon the whole series, and dealt with in a manner too intricate to be easily described, or, without drawings or models, understood. A perfect web of lace was formed, of six-sided looped meshes, highly elastic, and, of course, all weft, like the web from the original stocking frame. By the consentaneous opinions of all who could speak with authority upon such a subject, the mechanism of this frame was the most delicate of any ever employed in this or any other trade.

The next year—1778—by the efforts of John Lindley, Hiram Flint, assisted, it is said, by Morris, the point net frame was so improved as to produce a better article, that first made having been of a loose and inferior texture. In 1786, it was made a firm and durable article by Rogers, of Mansfield, or Hayne and Bagally, of Nottingham, each claiming the improvement. During several previous and subsequent years, Messrs. T. and R. Frost had succeeded in ornamenting point net upon the machine. From 20 machines at work in 1780, there were, in 1810, 1,500 point net frames, worked by men, making almost entirely silk net. 15,000 people were engaged in preparing and embroidering these goods for the market. A long war, decreased demand, and great competition, superinduced slight material and inferior workmanship. The decay of the trade by 1815 was complete. The last twenty-seven frames were sold from 1825 to 1828, and neither frame nor hand is, I believe, now to be found, of all those who, forty years ago, were so busily engaged in laying this the basis of the lace trade of Nottingham.

It may be mentioned here that, notwithstanding the extraordinary elasticity of cotton, and still more of plain silk net, the mode of payment to the workman was, for a long time, by the yard in length. This mode of measurement was so uncertain and capricious, not to say manifestly unjust, that much discontent was the result. At length, a method of self-registration, dependent upon every advancing movement of the machine, was found out, and being first applied to the "point" net frame, has proved the safe and unquestionable index of the workman's labour, and is now used in every mechanical department of the trade. Lace goods are now universally sold in the rough or unprepared state by this "rack" of 240 meshes in length, in the finished state by the yard, or dozen yards, or article, as the case may be.

In 1791, William Dawson, a stocking-needle maker in Nottingham, took out a patent for the manufacture, by machinery, of net, or lace sashes, purses, and braces. He was an ingenious mechanic. Dawson devised wheels, with uneven surfaces, which should, by their inequalities, raise or lower parts of the machinery, and which are now in constant use. He had Crane's machinery before him, in which the stocking loop was produced, not upon a continuous thread thrown horizontally across the machine, as in Lee's frame, but upon a series of threads placed longitudinally, as on the ancient weaver's beam, each of these threads answering to its respective "needle," or hook, and these threads looping, as the guides were passed under the long beard or hook of the needle, to which it belonged, were conducted sideways to the next needle, and then back again. Thus a solid fabric might be produced. If the meshes were removed by the application of the points in front of the needles, then an open-work mesh would be the result, which, by return of the loops and repetition of the process, would produce plain lace net work. This is the origin and operation of the present warp machine. At first, hosiery goods, such as cloth for trowsers, sailor's jackets, cut up hose, and gloves, were made from these frames, and some of these articles continue to be produced from them in large quantities up to the present time. A small quantity only of warp lace goods were made for several years, partly owing to the successful employment of the point net frame in making silk net, and the use of which for embroidery in imitation of French net was then very general, and perhaps, in some measure, to the want of two-thread cotton yarn of sufficiently fine numbers and good quality for the use of lace machinery. This desideratum was supplied, about 1805, both to the Nottingham and Buckinghamshire trades, by Mr. Samuel Cartledge, of the former place. Having succeeded in doubling it of the required quality, he introduced it into both businesses, and received, from the gentlemen engaged in cushion lace making, their thanks, at a meeting held especially for that purpose, at Newport Pagnell, in 1815. Meantime, the beginning of the present century saw a revival in the use of warp machinery for making lace. By 1810 it was competing successfully with the productions of the point net frame. For variety of productions and relative speed, the warp frame is undoubtedly the most universally applicable of any machine whatever. Every class of thread may be used—silk, cotton, animal wool. The stoutest fabric for warmth, and the lightest gossamer silk lace, are manufactured upon it with equal ease, and the necessary change of arrangements effected in an hour.

The manufacture of warp lace proceeded satisfactorily, subject to the fluctuations incidental to trade generally; but to which it may well be supposed an article of mere luxury must in every branch, be more especially liable. The variety of lace articles since obtained from the warp loom, has been almost incredible. Silk blonds and edgings, silk nets and laces, cotton tattings, pearls, edgings and laces—Doyley's, ante-macassars, of patterns effective from design, and thick threaded, pearled, and finished in the loom—are amongst the objects of the largest consumption. They are not only used at home, but enter into our export trade to a very large amount. The low prices at which they can be sold, combined with the durability of the heavier classes of cotton warp articles, make them the sure pioneers of our trade in more expensive goods, where, without them, but little lace would go. Orgill, Whiteley, Herbert, Gantley, and Dexter, have promoted the development of the capacities of the machine; Boot, Roberts, and Copestake, early pushed onward the warp fancy trade; and T. Herbert's fast pearled cotton tattings—Wild and Bradbury's laces and shawls—and Ball's velvet laces are instances of excellent efforts for the production of useful, elegant, and in the last named, almost regal novelties. There are in 1856, only about 550 machines—expensive wide having replaced less effective narrow ones. The number of warp machines making lace in 1843, was about 800. Of these 300 were employed upon silk, and 500 upon cotton goods. The machinery, buildings, &c., required a capital of about £350,000; employed about 5,000 hands; used up in raw materials £35,000 worth of raw silk of the value of £45,000 when prepared—and £25,000 worth of cotton wool of the value of £60,000—together £60,000, the cost of raw materials wrought up into £150,000 worth of silk, and £200,000 worth of cotton goods, making a total return of £350,000 for that year; of which £290,000 remained in the shape of wages, interest of capital, and profits. This business was, and is still transacted, by about fifteen houses in Nottingham and its neighbourhood.

All the machinery in the lace trade, if in factories, is worked about twenty hours a day, by two full sets of hands in shifts, each taking the night work in rotation. This is, therefore, the case with a large part of the warp machinery, of which the greater portion has been rotary for some years; and for the most part, these rotaries are worked by steam power. Wages are very similar in amount to those earned in the bobbin net trade. As there are no surplus labourers in the district, warp hands partake of the general prosperity of the class to which they belong. They are marked also by similar characterestics.

I have thought it most convenient to give the foregoing statement as to the warp trade without further interruption, in order to give a more perfect idea of its origin and progress. The above, which is about its present amount, I shall add to the statistics with which the paper will conclude.

Before proceeding to notice the more important branch of the machine wrought lace trade, that of "Bobbin net," the machine for making which is in different hands generally, the produce of both, however, going into the common mass of the Nottingham lace trade, I would remark as an important fact having a bearing upon the course and condition of each trade, that the warp and bobbin net manufactures, in regard to kinds of goods, style, patterns, and prices, act and re-act upon each other in a rapid manner. The machines in each branch, if of similar widths, are almost equally costly, (the bobbin net frames are the most so) both require great skill and nicety of construction, and each must be worked by hands of a superior class. These are circumstances which serve to keep up the general supply of mechanical talent and skilled labour. In times of difficulty, however, the quantity made has always been such as to issue in over production in those classes of articles which are common to both machines, and prices have suffered accordingly.

Reference to the two fishing net patent machines has been left until now, for reasons which will appear when we come to Heathcoat's patent of 1809 for making bobbin net.

In the Society of Arts Transactions, 1796, vol. 14, p. 273, is a drawing and minute description of Boswell's fishing net machine, for which he received the Society's award of fifty guineas. Boswell knew the stocking frame, and March's attempts to improve it. He uses roller beam, comb, sleigh, jacks, and hooks, and produced by using a single thread placed on a netting needle, and passed from side to side of the machine, a web of 68 meshes in width, and 8 feet wide when stretched out. The piece presented to the Society was 30 yards long. The corners of each mesh consisted of the true fisherman's knot, and of course were quite fast. The selvages were also perfect. It is an ingeniously contrived, though complicated frame; but has never been brought into general practical use. Boswell's letter to the Society speaks of "making exceedingly fine net from such a machine very shortly, as he hopes." I knew him well, and travelled abroad with him in 1824. He had not then realised such expectation, I am sure, or I must have known it.

Robert Brown, of Nottingham, patented in 1802 a machine for making fishing nets. G. Whitemore is mentioned as being concerned in the invention. Unlike Boswell, who used only one thread, and passed it horizontally across his frame, R. Brown used as many threads as he had looping hooks, and drew them off longitudinally. They were divided into two equal parts; one set put into metal bobbins, of which the sides were so far compressed together, as only to receive twine used in the making of the net. Each of these bobbins was inserted into a slot of iron; a groove in which received it, and allowed it to turn round, and give off the yarn; one of these bobbins and slot is on the table before us. This set of threads, Brown called "sinker threads." The other set were drawn off bobbins of the ordinary shape and width between the sides, which were fixed upon pins standing on a bobbin board, and this set he called "needle" threads. He provides for making loops, by using a set of hooks. Each hook makes its loop, draws it aside, and this loop being put into a triangular shape, large enough to allow the instrument carrying a bobbin to go through it, the thread is passed round and over the "sinker," which having passed, there is a knot formed. The threads which are thus passed round being then drawn tight, are thus firmly connected with the next ones, and the row of meshes across is finished. This effort at description has been thus particular, because the bobbin and instrument by which it was conveyed through the loops has assumed special importance; for this machine of Robert Brown's has been described as "possessing all the essential principles and properties of Heathcoat's second bobbin net machine," (patented seven years after this machine) "and to be to all intents and purposes a bobbin net machine. That to it must be traced the invention of bobbin and carriage; the method of using two divisions of threads, the warp and the bobbin; and to it alone belongs the beautiful idea of twisting two divisions of threads round each other." After more than one examination of the specification, and on each occasion assisted by talented mechaniciens, whose conclusions seem borne out by the document and drawings, I think it must be said, with every desire to do R. Brown's machine justice, that "in this specification there is no proposal for twisting threads round each other, nor does it seem possible to effect this process by this machine. The division of threads by Brown does not justify the use of the terms *warp* and bobbin. The bobbins and carriages are plainly adapted to pass through the loops of a fishing net maker, like his hand needle. Neither their design nor construction would necessarily suggest the bobbin and carriage of Heathcoat's machine. With the exception of the last named instruments, R. Brown's machine does not possess any of the essential principles or arrangements of Heathcoat's machine." R. Brown's fishing net machine never seems to have come into general use for making fishing nets. The specification says, "fine nets or lace might be made from it." I cannot find that he ever made any. His son observed to me lately, "that without the bobbin and carriage, twist net cannot be made—my father made the first bobbin and carriage, and patented it in the fishing net frame—fell into poverty—became insane. The trade gave him 12s. a week, and in a few years he died." It seems right to give his views, although I differ from the conclusion that the merit of the bobbin net machine belongs to his father. Robert Brown's ingenuity was unquestionably great; and under more favourable circumstances, there is no doubt he might have achieved success and fortune. He patented in 1804 an improved "Warp lace frame, to make Brussels, Valenciennes, tic-tac, and other lace." This never seems to have come into practical operation.

In passing, I must state that this son of R. Brown has arranged a bobbin net machine so as to produce some of the most intricate combinations of threads and meshes hitherto made. His want of means prevents his bringing it into use. I have the meshes, but have not seen the model, or a description of the principle on which it is constructed.

We now come to the circumstances attending the invention of the bobbin or twist machine. Many persons in Nottingham and some elsewhere, had been endeavouring since Morris's time, to produce by machinery an exact imitation of cushion lace. The difficulty lay in providing by mechanical movements, for the threads twisting round each other, and then travelling in three separate sets and directions, after thus twisting, *i.e.*, part longitudinally, and part to the right hand diagonally, the other part to the left hand diagonally. The names of most of these persons are forgotten. Some became lunatics, some committed suicide, others died from chagrin and want. Amongst those remembered still, and whose efforts were most noticeable, are the following; John Lindley, jun., spent much time in endeavours to produce twist and traversed net, after his assisting to improve the "point" net. A claim for the invention of the bobbin and carriage has been put in for him, under the excitement attending the contested patent rights in 1813. Some said, he had made a close approach to a single tier twist frame. Beyond the assertion, I find no trace of this at all.

It is probable that the efforts of Edward Whittaker were mixed up with those of Lindley, towards the time when the attempts of each were thrown aside. Whittaker made a machine, in which were eight or ten threads to an inch, producing an article (according to his statement) showing wavy lines, like blond net. He used a comb-bar like the jack-bar of a stocking frame. His threads were placed entirely upon bobbins, and each bobbin was fixed in a nick cut in a sort of carriage. Every other bobbin had to be lifted over the next one, and let down into the vacant space. The first ends of the threads were fastened to the further end of the horizontal machine; and the twist obtained was pushed up by the hand. Whittaker showed a bit of traversed lace, which he said had been made upon his apparatus. It would seem, relying upon all other and far more credible testimony, to have been hand made, and that lace never was made mechanically by him. This attempt to mechanise the art of lace making, presents the use of a modified shuttle and pirn—a not very manageable bobbin and carriage, not reduced into the size necessary to pass through the space occupied by an interstice of lace. His other mechanical arrangements were not calculated to forward, much less to attain, the end proposed.

Then Charles Hood, knowing him, through being connected with Taylor and Hood, who furnished Whittaker with the money expended in his attempts, and seeing (as he C. Hood asserted) that lace could not be made from the apparatus, as it was put together by Whittaker, took the project out of his hands, and modified the machinery. According to one, C. Hood dismissed the bobbins and carriages; another avers he continued their use. His machine was horizontal; the bobbins were lifted by alternate shifts each way, one half over the other, and thus a twisting process was carried on. He carried up the twist for perhaps two yards or more, by means of a row of at first wooden, and afterwards iron pins or points. The crossing was forced up in like manner. Thus he made upon two such sets of instruments, about twenty yards in length of a net about nine inches in width. This lace did not traverse, but was a straight down net. Thus, C. Hood stands in the position of having far more nearly approached the solution of the difficult problem in hand.—There seems to have been on the part of John Moore also, as near an approach, or even nearer, to making a twisted net. But he failed in obtaining a traverse. His further efforts were rendered useless by Heathcoat's success. He appears to have been a clear-headed mechanic.

Amongst all these parties there seems to have been but little distinct idea of what was really necessary to be done. Parts of machines there were, lying on all sides of them, which, perhaps, might be made mechanically available. Many things, as in the common weaving loom, its warp beam and division of warp threads in the reed. In the stocking frame, its "slea" and "comb," and "guides," the "points" of the point net machine, and many other instruments might be adopted or adapted. But the grasp of mind necessary to choose, or invent, or adapt what was needful in the accomplishment of this mechanical feat, was not an every-day manifestation of genius.

It was during the time that the persons we have named were labouring and planning ineffectually, that John Heathcoat entered upon and accomplished it, after several years of great mental labour, and occasionally some serious physical privations. He was a native of Long Whatton, in Leicestershire, and between his twentieth and twenty-fifth years, was employed as a smith and setter up of warp frames in Nottingham. During this time he turned his attention to the question of constructing a twist traverse net machine. More than one circumstance had fixed his mind from boyhood on this problem, and he determined, if practicable, to solve it. He first got a sight of pillow lace, in process of making; then carefully dissected the product. Tracing the threads, he soon found they might practically be separated into three classes—longitudinal, right, and left diagonal. After much reflection he was led to the conviction that the longitudinal might be put on a beam, and so constitute a warp. This discovery simplified the subsequent processes, in attempting to mechanise the operations of the pillow. Having thus constituted the warp of half the threads necessary to make the lace, Mr. Heathcoat proceeded to put threads on an equal number of bobbins or spools, analagous in shape to those used by the cushion lace makers. These were arranged on pinions, and radiating, they were made to twist round the warp threads. A row of pins forced up the twist and crossing, to close up the mesh of right size and shape. These pins were placed on a bar, but they spread out on receding from the work, and contracted when brought into contact with it. At first the bobbins had been placed in a straight line, but thus arranged the side ones gave off too much yarn; therefore, they were placed in a segment of a circle, all working at equal distances from the net when formed, in whatever position they might happen to be. The bobbin threads were made to traverse, the one half to the right, the other half to the left, each one, as it arrived at the side, being caused to return until it reached the other side, and so on. From the space occupied by the bobbins, only very narrow strips of net could be produced upon this machine. Nevertheless, it might justly be described as a real mechanical pillow for lace making. In the opinion of many men of high mechanical talent, and adopted and expressed by Serjeant Copley in 1815, it was an extraordinary instance of mechanical genius. This frame was patented in 1808. About five meshes of plain net can be made per minute upon the pillow. By this frame, as the twistings and subsequent crossings took place across, all by one movement for each operation, as many *rows* of meshes could be produced per minute.

Upon shewing the net of an inch or so in width produced in this manner to Mr Chas. Lacey and Mr. Thos. Fisher, the patentee found that the usefulness and value of lace is much enhanced by its greater width. He, therefore, decided to attempt making it a yard wide. The warp fixed upon a beam secured all that could be necessary in regard to one-half the threads, of whatever width the machine might be. The bobbins must, however, be got to pass and re-pass in the same space. The large bobbin was discarded, and a flat thin bobbin put into a carriage just thick enough to hold and convey it was contrived, and, after many difficulties, made thin enough to do the work. It had been intended to pass and re-pass all the carriages in one set. This plan was afterwards adopted by J. Levers, in the machine now extensively used, bearing his name; but to get, at that time, the bobbins and carriages made thin enough presented such a difficulty that Mr. Heathcoat hit upon the plan of dividing these into two systems, and thus was enabled to use them of double the thickness. The carriages had a long steeple top to carry up the threads nearer the work.

Thus this second machine, known as the "Old Loughborough," from the place to which the inventor had removed, was patented by Heathcoat and Lacey in 1809, and was capable of producing any width of net required, though they were at first constructed only half a yard or a yard wide. The threads were twisted and traversed; bobbins and carriages worked double tier; had a warp beam, a work beam; bobbin threads carrying each way diagonal weft; travelling in carriages, taking the thread from before the warp threads between and behind the warp threads, and *vice versa*. There were movements for shifting the whole sets of threads in warp and bobbin series laterally, by which the sets of threads changed their situation respectively, and twisted the bobbin threads round the warp threads. Also, for passing the bobbins and carriages, half one way and half the other way, sideways, exactly the space between two neighbouring threads of warp, so as to cause a crossing of these bobbin threads to form the top and bottom of each mesh. There were rows of points answering to all the pairs of twisted threads and crossings to force them up to the work beam, and to hold up the work when brought there. The warp threads were passed through guides. Four combs (since reduced to two) were placed at suitable intervals, through the circular segmented grooves of which the carriages safely travelled; and a very ingenious plan was devised of causing the last carriage on each selvage to be left behind one move, and then to enter upon the return course to the other selvage.

The increased width of the article produced by this second machine caused the first patented one to be permanently thrown aside. The introduction of the article into the market formed a new epoch in the lace trade of Nottingham. The second patented machine was a complicated one; it required sixty motions to the formation of a mesh. A workman in one of these machines, 36 inches in width, could produce 1,000 meshes a minute. The motions have gradually been reduced to six, and a machine five yards wide will turn off 40,000 meshes per minute with ease. The first finished pieces were sold at 100s. the square yard; in 1813, 40s.; 1815, 30s.; 1818, 20s.; 1821, 12s.; 1824, 8s.; 1827, 4s.; 1830, 2s.; 1833, 1s. 4d.; 1836, 10d.; 1842, 6d.; 1850, 4d.; 1856, 6d. The last is about a natural average price.

The title to the invention of a machine whose incipient capacity was so greatly in advance of previously known means of production, and which was soon found capable of improved action, and vastly extended powers and results, was not likely to pass unquestioned. Accordingly, a number of claimants for the honour, if not the profit, of the invention, arose on the one side, and infringers quietly set to work on the other. Much was said and written during the patent to lessen and impugn the claim of Mr. Heathcoat. I have diligently consulted a surprisingly voluminous mass of papers, briefs, and evidence on all sides, and, as far as possible, on all points of the controversy. It has been my desire to use impartially these materials, and to give Lindley and Whittaker their due for their bobbin; to R. Brown, for his bobbin and carriage; and to Charles Hood, for using these instruments, so far as he did employ them, in approaching more nearly to success than any of his predecessors. Also, it may be presumed that Mr. Heathcoat might, and almost of necessity must, have had his mind directed in some degree to the attempts of others. Before completing his own machine, he had, however, seen none of either Brown, Whittaker, and Hood's machinery. To him, I have no doubt, belongs the singular merit of inventing the twist traverse or bobbin net machine. Most of the instruments he used were known before, but used for other purposes, or in other combinations. Some had been employed in unsuccessful efforts to do that in which he succeeded. In the hands of his competitors, these instruments had been practically useless as to the solution of the intricate problem. Whatever these might be, Mr. Heathcoat relegated the necessary parts into their appropriate position, giving them form and movement by his mechanical skill, suitable to the attainment of the end he had in view; and thus, as it seems to me, not only was the first to construct (which now no one doubts), but *invented the machine.* You know the lacemaker's cushion; you have the machine before you, and will form your own estimate of the patience and skill displayed in its construction. With Lee's exception, they appear to me to be unique. The opinion of Sir I. Brunel, and adopted by Sir V. Gibbs, on the trial of "Boville *v.* Moore," 1816, seems the right one, and will in time be generally acquiesced in, "that when Mr. Heathcoat had separated one half of the threads, and placed them on a beam as warp threads, and made the bobbins which carried the other threads act between and around these warp threads, so as to produce Buckinghamshire or pillow lace, the lace machine was invented."

The occasion of this trial was important. *John* Brown (not Robert), the real plaintiff, had patented, in 1811, a bobbin net machine, in which, using every one of Heathcoat's essential parts of the machine of 1809, he caused the *warp* threads to traverse, instead of the *bobbin* threads. Finding Moore working a similarly constructed "traverse warp" machine, he brought an action for an infringement. A verdict was given for Moore, the defendant, on the ground "that both machines were infringements upon Heathcoat." Serjeant Copley defended Moore, receiving 100 guineas fees. The defence cost £4,200. The future Lord Lyndhurst was determined to understand the machinery practically, and worked the model on the table with such ease and skill, as to astonish alike judge, jury, counsel, and spectators. An omission by a copyist of one line in the patent induced Heathcoat not to stop infringers until after this trial had indirectly established its validity. Before this patent, only about fifteen lace patents had been granted during a hundred years. Since, there have been upwards of one hundred and twenty, chiefly for modifications of the bobbin net machine; some of them, however, of great ingenuity and importance, also of most expensive character; all, as in the "old Loughborough," divide into the essential systems of the warp and bobbin threads—twisting and crossing. In dealing with these operations, and governing their results, admirable skill has been displayed, which we shall proceed to notice in the improvements as they occurred.

The "traverse warp" just spoken of was specially adapted, and has ever since been used, for the production of narrow breadths, spotted laces, blonde edgings, and imitations of real cushion laces. The singularly clever way in which Heathcoat's machine was travestied, was noticed by Mr. Babbage, twenty years ago, when inspecting the traverse warp with me, at Moore's factory, and he described it as showing "great genius and little science."

In 1816, there were found to be one hundred and fifty-six infringers, of whom were two clockmakers, two blacksmiths, one victualler, two butchers, one coal-dealer, one joiner, thirty-one framesmiths, and one hundred and sixteen manufacturers of lace and hosiery. This state of things led to a levy of tribute or license money. In 1819, about £10,000 was paid to the patentees for the year's tribute upon about 600 machines. Heathcoat had then 147, and Lacey 127 machines, of course additional to the others. Notwithstanding this charge, levied weekly, and the outlay upon the construction of each machine of several hundred pounds, the profits gained were so large as to attract into the fabrication nearly all the mechanical skill and spare capital of the district.

Amongst the plans brought out to adapt this machine for the production of special classes of goods, in 1812, the "pusher" (so called from one of its operations) was constructed by Samuel Clark and James Mart, of Nottingham. This frame, with the Jacquard principle applied, is now employed to a limited extent. Cotton net and silk net are made upon it, with excellent "fining cloth work" of suitable patterns, to be finished by the needle-embroiderer passing thick threads around and through them. Cushion goods, in such articles as shawls, berthas, veils, &c., are closely imitated by this process. Mr. Vickers and Mr. Reckless have long been eminent in this department for the superiority of their designs and work. Specimens of Mr. Vickers' taste are before you. The "mantelet" required 4,250 cards.

An ingenious machine was constructed about 1816, by John Hill, to produce a plain ground, each mesh having two platted and four twisted sides, in exact resemblance of real plat work. The mechanism worked horizontally, required great space, was very slow, and its product was too expensive to answer. Several of these machines were, however, worked under the care of a Miss Woodward, of Basford, for two or three years.

To Mr. William Morley, a mechanic of Nottingham, the trade has been indebted for several important practical improvements. He arranged his "straight bolt" in 1811, but though there were improvements in the spur selvage wheels, and for the change of the bobbin and carriage in reaching the selvage, which have ever since been retained, the peculiar action of the "straight bolt" in the machine drew thread irregularly, and resulted in uneven courses of meshes. He saw the defect could be remedied only by returning to the circular combs; he therefore reduced them from four shorter combs, as in Heathcoat's frame, to two longer segments of circles, as at present in use, and otherwise simplified the movements of the machine. This gentleman possessed much mechanical knowledge in connection with this business, and by his skill and industry accumulated great wealth. He died a few months ago.

Mr. Heathcoat took out another patent for improvements in 1813.

Mr. John Levers, senr., of New Radford, Nottingham, assisted by one Turton, arranged a machine (called by his name) upon the single tier plan. By this time the very thin bobbin and carriage required, and which had induced Heathcoat to lay aside this system, could be made with much less difficulty. To avoid the patent right, he made his machine at first horizontal; it would not work properly, so he soon restored it to the perpendicular position. This machine is far the most delicate, and, therefore, the most expensive of those principally used. It, however, admits of such alterations of meshes, fine work, thick threading, and all kinds of breadth patterns, especially narrow ones, all being of late years regulated and governed by Jacquard apparatus, that this system of machine cannot be too highly appreciated as to its usefulness. Mr. Birkin, who has, with singular talent, comprehended the power of this machine, and by seizing the most important classes of real and other laces, particularly plat cotton laces, and black and white French silk, blond, and other edgings, and bringing them perfect off the "levers," exhibited a good specimen of his "levers" machinery. It will be recollected in the year 1851, in Hyde-park; since then the product from this class of best silk laces has been unparalleled. Mr. Birkin's productions from the Levers' are on the table.

About 1815, Mr. J. Lindley, of Loughborough, in connection with Mr. Lacey, (the partner in the patent with Mr. Heathcoat) brought out a plan, in which was an endeavour to combine the peculiar systems of the "levers" and traverse warp, and to be worked by a rotary hand movement. Unhappily for the originators of the scheme it proved unsuccessful and ruinous to them, in the business they carried on at Tottenham, Middlesex. If for nothing else than containing a proposal for a rotary action, it was an important effort.

The practice of frame breaking, beginning in the three hosiery Midland Counties in 1811, was revived at Loughborough in 1816. Heathcoat and Boden's factory there was entered, and the principal part of thirty-seven lace machines was destroyed, depriving them of seven or eight thousand pounds worth of property. Ten men were tried and convicted, and eight of them executed for this offence.

The owners forthwith removed their business to Tiverton, Devonshire. Mr. Heathcoat has now in his possession upwards of three hundred machines. They have all been constructed on the circular principle, and have had rotary motion given, chiefly by means of water power, which is supplemented by steam. The larger part of this machinery has been employed for the last thirty years in making silk net. "To his zeal and perseverance the trade is indebted for the discovery and application of the dress and finish of silk net as practised by the French, and which is giving by the demand it has created, employment to a large capital, and thousands of work people in the bobbin net trade." From Tiverton, off shoots took root at Barnstaple and Chard, in which places together about 400 machines are at work. The produce of Tiverton is sold in London; so is that of Mr. W. H. Nunn's traverse warp factory; also usually making silk goods, which is located in the Isle of Wight. With these exceptions, the produce of the whole English machine-wrought trade is sold in Nottingham, through the medium of about one hundred and fifteen wholesale houses.

The great increase of machinery in this trade had drawn attention in 1816 to the necessity for improved qualities in Manchester fine yarns. From that period, numbers from No. 80 to No. 280 in Nottingham trade, have found an increasing consumption, and as lace machinery soon spoils if not constantly worked, a more regular demand exists there than in any other branch of the cotton trade. Several large doubling establishments have been long at work in the town and neighbourhood; others, still larger, for throwing silk, are in active operation there. Three years ago Mr. John Morley, the public-spirited son of a worthy father, Mr. W. Morley mentioned above, commenced successfully to *spin* fine numbers of cops, as well as to double them into yarn in Nottingham. In 1810, No. 220 doubled yarn was 100s. per lb.; in 1856, 10s.; 240 was 140s., and is 13s. per lb.

It had been observed by Mr. Samuel Hall, of Basford, Notts., to whom not only this but other trades are deeply indebted for his scientific improvements, that both cotton yarns and fabrics, especially lace net, were fibrous, and the interstices not clear. He patented inventions for passing both thread and nets, or other substances, through gas or other flame, and thus singeing off fibre without injury to the articles, thereby effecting a great improvement in them. Mr. Hall's improved starch is well known. He was the first, so far as I know, who availed himself of extended advertising to get an invention or article into demand. His specimens of gassed thread and lace fairly placed beside ungassed ones, will be remembered as being found in every number of several periodicals for years together. He effectually made Urlings (*i.e.* bobbin) net known far and wide.

Great profits increased lace machinery and stimulated production so much, that the patentees and licensees agreed, in 1819, to send their goods to be sold at a "mart," constituted by deed, with a proprietary committee and common fund for its management and support. To this appear the signatures of patentees, 82 manufacturers, and 82 other owners of frames. The widths of frames of patentees had grown to be 5 qr. to 8 qr., of tributaries 3 qr. to 6 qr. wide at that time. This scheme kept up prices, and, of course, increased the machinery and infringers at a great rate. Notwithstanding high professional opinion in favour of its legality, general opinion protested loudly against it, as an infringement of the rights of purchasers and the public. Just in face of the expiration of the patent, its operations came to an end.

In 1820, steam power was in use; in 1822, it was largely employed, and machines were drawing together into factories. Everything combined to lead people in Nottingham and its neighbourhood to expect golden times, when the patent shackles should fall off. So, in 1823-4, capital was flowing in abundantly from lawyers, physicians, clergy, landlords, tenants, and traders, to create lace machinery. Every available smith and mechanic on the spot was hired, and to them were speedily attracted by the wonderful wages offered smiths and mechanics from far off towns. Day labourers came from the plough, and strikers from the forge. Clerkenwell watchmakers and Manchester engineers met on one common ground. Thousands of pounds were wasted in paying five to ten pounds a week in wages to people pretending to make machines, the movements of which they did not comprehend; and tens of thousands were drawn from speculators not in the trade, for machines which, if ever so well constructed, could not repay *them* their outlay. The demand for goods was, no doubt, immense, but prices necessarily fell. Enlarged consumption was met by still larger supplies. Both patentees and licensees had put into operation the most improved and speedy machinery in their power, and, of course, reaped the larger part of the harvest which accrued. The mania was called, "The Bobbin net fever." The inflation of mind was universal and complete. Nothing like it was ever seen in that trade before; and, unfortunately, the speculative frenzy of the nation, in 1825, had countenanced it. So, with the national collapse of 1826, came that of, miscalled, "Bobbin net prosperity," and a fearful one it was. Many lost all their means, and fell into hopeless poverty; others died, or went into self-imposed exile. The immigration had been for a time so great that Nottingham proper (always too densely populated) could not contain the people. The population burst its bounds, and so has continued to overflow ever since. In 1811, the numbers were 47,000; in 1856, 110,000, dwelling in the town and suburbs, an increase chiefly owing to the lace trade of which we are speaking. The circulation of money throughout the wholesale and retail trades of the town, was very much increased. Wages received by first-rate workmen were unexampled, and so was the thoughtlessness of too many. Journeymen rode on horseback to their workshops, and, having taken their shift at their machines, would daily refresh themselves with a pint of port or claret on their return. Some of these spendthrifts I have seen relieved at the parish pay-table twenty years ago; all, however, were by no means so unthrifty. One, who somewhat before that time began his mechanical course by mending his widowed mother's tea-kettle in a leisure factory hour, concluded his intelligent and indefatigable career in the Bobbin net trade, by purchasing, a few months since, for £60,000, a landed estate. No business has furnished more remarkable instances of success, and none of greater disappointments. Nevertheless, the working class has included every name I shall have mentioned in this paper. From these my own must not be excluded. From its beginning, and through every stage of its history, the men of the loom and of the forge have furnished the talent, the energy, the self-denial, which have been displayed; and have secured their share of the results in profit and the money capital of this remarkable trade.

Another proposed "mart" in 1826 did not come into operation. In 1828 the effort was again unsuccessful. But in place of it, a Committee of owners of machines and their delegates was constituted to regulate and control the working hours of the machines already in the trade, and to dissuade from constructing more. A restriction to twelve hours a day was carried out for the following ten months; and meantime, the owners of 3,307, out of the 3,842 machines, then found to be in the trade, signed a deed, binding those who signed it, that when the owners of seven-eighths of the machines had put their names to it, to obey the directions of the Committee constituted by it, and keep the working hours they agreed upon. But when the required number within fifty-five machines had been signed for, the dissidents amongst the owners of those unsigned for were found too important to be overlooked or trifled with. The restriction and the Committee were both given up. A memorial was signed by 1,808 journeymen in two hours in Nottingham, praying for continued restriction. From my position and in the hope of useful results, I was induced to occupy the chair of that Committee. It was a singular experiment, costly in labour and anxiety, though not in money, for it expended only £400. The machine owners had their profits raised £240,000 by that year's restriction. But this addition to their funds, ended in 650 new machines, of vastly better make and power, being added in that and the next year to the trade. One member of the Committee, himself very loud for the restriction, added forty-four machines to his lot, and of double power of production. They cost him £10,000. They were sold in the next trade panic for £600. Notwithstanding this experience, in 1834 and 1885 further bolstering of prices was attempted; but at that time and since these factitious plans have only had partial and brief operation. The great cost of the machinery, large profits, high wages, and rapid reduction in prices, may account for, but cannot justify these departures from the laws of demand and supply.

At this point of these historical remarks, it may be well to point out, that in 1816, the first machine (a traverse warp) was taken to France and set up at Douay, by Corbet, Black and Cutts for M. Thomassin. In 1817 Webster, Clark, and Bonniton, took a 36-inch (straight bolt) to Calais. Shortly after, Mr. Heathcoat introduced some into and constructed others at his factory at Paris,—since removed to St. Quintin. These were the adventurers who laid the first stones of the great structure which has since been raised in the North of France of this important trade. Mr. Delhaye, my fellowjuryman, in the Paris Exhibition, constructed, while a workman in Calais, the first French built machine. The Calais machines numbered in 1839, 705; 1834, 801; 1851, 603. Many have been replaced by wider and speedier ones. They had three pushers, fourteen traverse warps, 124 common circulars, 141 Jacquard circulars, and 321 levers. Calais has increased from 4,000 inhabitants in 1816, to 11,000 in 1851. Their lace business employs 50,000 females, besides the ordinary proportion of machine hands and attendants. There are 800 other machines; at Boulogne, St. Omer, Douay, Lille, St. Quintin, Caen, and Lyons. More expensive classes of goods are usually produced upon French machines than upon ours. Their fine yarns not being of equal quality to the English, forces them to purchase the latter largely. The English plain nets, which were formerly extensively smuggled into France, are now supplanted by their own; while they import into London their wrought laces and embroidered goods, and even some plain nets with advantage. They have applied the Jacquard apparatus to their machinery with much success; and of late years have ceased to copy Nottingham patterns, turning their own taste in designs to good use and profit.

There were at Brussels, in 1850, 16; Termonde, 8; at Malines, 5; at St. Josse, 4; in all, 34 machines in Belgium, chiefly making three twist Brussels net, upon which cushion flowers are applied. These are high priced articles when finished for the market, and justly of high repute. To dismiss foreign bobbin net machinery, there are, probably, in Switzerland, now 80; in Saxony, 70; Austria, 100; Prussia and Russia, 30; in Spain and other countries, 80; altogether 360.

The Nottingham trade had for some time cast an anxious eye upon the increase of French bobbin net machinery. In 1834, they prayed the Board of Trade to endeavour strenuously for commercial reciprocity with our neighbours. Dr. Bowring's mission failing, they tried hard, but unsuccessfully, to stop the export of Nottingham machinery. In 1841, they gave an unqualified dissent to the proposed free export of machinery. Government and Parliament were in its favour. All these exceptional plans for relief of trade, and protests against external one-sided competition, were unmistakable symptoms of surplus power of production in plain goods, which till then formed nearly the whole staple of the trade. Its safety depended upon getting the major part put upon producing fancy goods. I had taken the unusual step of compiling and publishing a census of the trade in 1831; again in 1833 again, in an equally elaborate form, I took a very minute one in 1886. The particulars thus made known were felt by many to be both striking and important.

I saw a machine for which Samuel Draper took out a patent in 1834 for drawing both his longitudinal and diagonal threads from separate bobbins, and operating upon each by a barrel organ. And again, in 1835, the patented machine, by the same man, for an application of Jacquard apparatus to a bobbin net machine. In this machine, Draper arranged to operate upon all the threads by individual action and selection. His system was not successful, and cost a large sum of money in the experiments. Draper took out, in 1837, a patent for Jacquarding the warp machine. Others have followed him successfully in both departments. He is living in deep poverty in Nottingham. All these and other plans having a similar object in view, falling under my eye, I wrote a fortnightly series of articles, from 1833 to 1836, urging through the local press the importance of fancy trade to Nottingham, the use of the Jacquard, and the necessity for a school of design. In 1841, Hooton Deverill patented the Jacquard application to the ends of bars placed in the machine. This great improvement was first made in the Levers' machine, by the purchasers of the patent-right, Messrs. Biddle and Birkin; and by others, since then, to the circular. It may now be said to have become general. A new development of the trade has taken place in consequence. The era of ornamenting lace upon the machine has certainly been ushered in; the results are new, startling, and of incalculable importance. Every fancy article, from the narrowed lace edging to the two-yard-wide store curtain, requiring some thousands of cards to complete the design, are now as much familiarised to our mechanicians, designers, and workpeople, as they were, twenty years ago, unthought of or unknown. The School of Design has been far more effective for good, in promoting knowledge of the principles of design, of taste, and its application to our peculiarly difficult fabrics, than I thought possible in so few years, when I first broached the proposition in the press of Nottingham. Our artizans, in particular, are not like the same class of men; and our embroiderers are equally impressed with the necessity for beautiful patterns. In these respects, the trade is undoubtedly placed on a more solid foundation than it ever was before.

Besides those already named as engaged in working out this fancy department mechanically I shall especially particularise three persons who each played an important part. John W. Bagley, a working shoemaker, unassisted, made himself so thoroughly acquainted with the principles of the bobbin-net machine as to produce any known mesh upon it. He first introduced extra guide-bars, and thus made honey-comb. This was a leading idea, developing other great results. By it he gained little, the trade very much. Bars to the number of 300 have since been made to act in one machine, and each under individual control. About 1837, he first saw real plat net—discovered it must be made by using a double warp—exclaimed "I have got it"—and in a few hours produced the mesh. For this plan Mr. Fisher gave him £100, and, on patenting it, liberty to use one license. This patent, taken out by Crofts in 1838, brought the patentees, it is said, a large yearly tribute for several years, besides the profit derived on their own numerous machines. A machine having £100 spent upon it in putting it upon this plat net frequently returned the outlay in a month. After some years, Bagley produced a perfect imitation of real Valenciennes narrow laces, scarcely to be distinguished from the hand-made article. Since then, he has succeeded in producing the texture and floral combinations of Honiton lace. For these, as exhibited in the Palais d'Industrie, 1855; I obtained from Jury 23, an unanimous allocation of the silver medal. It is a well earned reward, the only one his genius, labours, and sufferings have yet brought him. He can improve a bobbin-net machine, but not the opportunities it affords for making profit. With extraordinary talents, he is possibly as far from affluence as when he began thus to employ them.

To Mr. William Crofts, once one of the quickest and cleverest hands working in a Levers' frame, afterwards long connected with Mr. James Fisher, the trade is indebted for devising several important improvements of his own, and perfecting or bringing into successful operation those of others. In 1828, he arranged the "Levers" turnagain now in general use. He took out the "spotting" patent in 1833. Spotted goods are too beautiful and useful to go out of demand. There was one point, however, of great moment to the trade, which resulted from the numerous patents taken out by this gentleman and the great capitalist with whom he was connected, viz., the general disinclination to adapt machinery for fear of infringement. The patent of 1835, called, from its variety of claims, the "monster patent," required 49 sheets of drawings. I learn from Mr. B. Woodcroft that the 250 copies required for the Government publication of this patent will cost £250. When a society was formed in 1838 for mutual protection against actions for infringements, it was found Mr. Crofts had then about fifteen patents running; to these were to be added about forty unexpired, taken out by other parties. An action for infringement of Croft's plat patent was compromised in 1847, since which the trade has rested in quietude, and the mania for taking out patents has subsided into rationality.

About 1846, William Livesey, a person working a few machines on his own account, at Lenton, Nottingham, put on one for the purpose of making a straight down, looped, yet open and stout mesh, to be ornamented on the machine, with suitable patterns. Though not able fully to realise his design, yet it was not long before it was perfected, chiefly by the aid of Elsey, Sisling, and Cope. The Jacquard is applied to the back bobbin threads individually, and to the bars worked from the ends of the machine. By this machinery a new and important branch has been added to the Nottingham trade. One hundred and fifty wide machines are making large quantities of curtains, curtain nets, anti-maccassars, &c.; for such is the speed, that a pair of curtains four yards long, and each two yards wide, is produced in two hours. If, in addition to taste in design, the durable quality of this production is sustained, there can be no doubt it will take a permanent place in our trade. The size and conspicuous position when in use, of these articles, require energetic application of the art of design. As in the case of embroidered lace, &c., so in regard to this class, in order to advance true taste in the patterns produced, a small school of practical design is attached to each of the factories in question. The expense of each such school is about £1,000 per annum. The pair of curtains placed before you, is from such a school in the business of Messrs. Heymann and Co. The bed-cover required 13,000 cards, the weight of which is 1,000lbs.

One of the follies, resulting probably from an unhappy tendency to follow in an unreasoning manner, the practice of some eminent name known in the trade as that of a successful man, and which has been practised in this trade to a greater extent than any other, I suppose, has been that of breaking up machinery, narrow and slow certainly, but otherwise useful. Mr. Heathcoat and one or two more have utilized these 8 qr. and 10 qr. machines, and to great profit. The rage has, however, been to build 16 qr. to 20 qr. of late years. I have an account of 3,000 machines, averaging nearly 7 qr. in width, sold in the eleven years, 1824 to 1835 inclusive. This body of machinery was, for original cost, ingenuity, and excellency of workmanship, such an one as was never before sold for old iron for £15,000, having cost £2,000,000 sterling. In 1824, a 7 qr. sold readily for £600; in 1835, such were cast out of top storey windows into the street, at the cry of, "Old rags and twist machines to sell." Many sold for £3 each, which, in 1836, would, by trifling adaptation, have repaid all charges, and put £100 into the owner's pocket by a month's employment. A 20 qr. 20 point, making "point" lace, cost the owner £3,000, it sold on his insolvency for £300. Fancy machines only numbered 200 in 1833, in 1836 were 1,250; in 1856 there are 2,150, including the most expensive (Levers) that are built, and which cost from £500 to £1,000 each. On these, silk laces are produced, having fining, thick threads, pearl, open works—everything finished upon the frame. A piece costing £50, has only the connecting threads to be drawn out, and it is ready for the market.

In 1831, embroidering and finishing of lace employed wholly, or in part, about 150,000 hands. They received wages £1,500,000 in the year. This fell, in 1833, to £550,000, and 55,000 hands; and, in 1836, to £350,000, and 35,000 hands. Including wages at the machines, as well as the subsequent processes, there has been paid to at least 130,000 hands, in 1856, £2,200,000 in wages alone, in this department of the Nottingham lace trade.

In conclusion, the manufacture of bobbin net lace by machinery is scarcely half a century old. The following will give an approximate idea of what in this brief interval it has become in this country:—

At several periods an account of the machines has been taken. In 1815 there were 140; 1820, 1,008; 1826, 2,469; 1831, 4,500, making a return of £3,417,000; 1833, 5,000, returning £2,620,000; 1836, 3,800, returning £2,212,000; 1844, 3,200, returning £2,995,000. In 1851 Mr. Birkin, reporting to Section 19 of the Great Exhibition, found 3,200 (34,382 quarters width) at work, returning £2,300,000, employing about £2,965,945 capital, and 133,015 hands. Capital in bobbin net machinery alone was estimated at £1,329,445.

In 1856 the machinery is increased to 3,500 (full 40,000 quarters in width), and greater power in production in the new ones. Also a far larger proportion is employed upon silk materials, and the number of frames making fancy goods forms now far the largest proportion. These changes will serve to account for the very large increase in the returns of the trade this year beyond 1850. 1,350 machines at least are rotary circulars, making plain goods by power in factories. At least 1,050 making fancies are worked by power, probably many more. About 2,158 machines in all, partly "Levers," partly circulars, some pushers, and some traverse warps, make fancy goods now. The materials are all imported, and cost on importation during the past year £920,000. The returns were £3,680,000, or thereabouts. This left for wages, interest, and profits, £2,760,000.

If to these figures be added the cost of raw materials (all imported) in the warp lace trade, £60,000, and the ultimate returns, £360,000, the result of the operations of the entire machine-wrought English lace trade will be:—Raw materials used, cost £980,000; total returns, £4,040,000; paid in wages, interest, wear and tear, and profits, £3,060,000. The entire number of hands employed may be stated at 135,000.

The trade was, until 1850 or thereabouts, cooped up in small unsightly workshops and warehouses, for the most part, but has been transferred, to a large extent, into some of the noblest buildings of which any manufacturing town can boast. Factories, dressing-rooms, and warehouses, are alike becoming spacious, airy, and, I trust, healthy; at least £250,000 has been expended within the last seven years in this class of improvements.

The torpidity of the home market during the last year, and the activity of demand abroad, has so changed the relative amounts of export and home consumption in lace goods, that it is not in my power to do more than indicate Germany, the United States, Canada, Australia, and the East Indies, as the principal markets for supplying foreign consumers with British machine-made lace.

This manufacture has always been exempt from the operation of the Factory Acts. Necessity for relays, arising from the unusual cost of the machinery, and the peculiar character of some of the operations, have been the chief reasons assigned.

There are no unemployed people in connection with this trade at this time, but rather a scarcity of workpeople in every department. Wages, therefore, have somewhat risen in general; for the labour of women and children considerably, during the winter and spring months. As the circumstances are exceptional in some degree, to attempt to give a scale of earnings would only be calculated to mislead. It is, however, gratifying to state, that the comfortable subsistence of the employed never was more easy nor more certain of attainment in Nottingham than at the present moment.

A large part of the work necessary to be performed in preparing all goods for the market is done at the dwellings of the people, thus affording domestic employment, paid for by the piece, to women and children, often such as from circumstances can only be partly engaged on such work. In these cases it comes in aid.

It is believed that the amount of infant labour performed in Nottingham has decreased for some years. It is still, however, an opprobrium, and ought not to exist, in connection with what is ordinarily a fair average rate of wages for adult labour.

On the whole, the people engaged in the trade we have been considering, are intelligent, active, independent, and respectable, as becomes those who have to meet the constantly varying requisitions made by a business which cannot sustain its present important position in the markets of the world, unless by the supply of articles distinguished for their soundness of quality, novelty, purity of taste in design, and skill in execution.

DISCUSSION.

The Chairman said, the hour warned them that they could not hope for much discussion on this interesting subject; but, whilst this was perhaps the longest paper of the session, it was certainly one of the most interesting; and at no period of the reading of it had the interest of the audience flagged. Mr. Felkin had brought forward a number of striking facts, which could not fail to have made a great impression on the minds of his hearers, but he had omitted one or two facts which had occured to him (the chairman), and which he would mention. Connected with the lace trade was the stocking trade, and in the Exhibition at Paris a mistake was made, by the French and foreign visitors taking the price of a dozen pairs of the Nottingham stockings as the price of a single pair. Nottingham manufactured stockings were shown at the Paris Exhibition from 2½d. per pair and upwards, that was something like 3s. the dozen pairs; and such was the quality of those stockings that visitors, and, he believed, some of the trade, thought they were worth 3s. per pair, and it seemed almost fabulous that the price should be under 3d. A remarkable fact mentioned in the paper was, the great reduction which had taken place in the price of the bobbin net lace, viz., from 100s. per square yard to 6d. Coincident with this extraordinary reduction in the price of the material, was the fact that, from improved machinery and other circumstances, the people engaged in the manufacture of that article had increased in prosperity. He believed it was the case that, whilst this extraordinary economical fact was exhibited, the workpeople engaged in that trade had advanced in the scale of social comfort, and this extraordinary transition appeared to have benefitted alike the producer and the consumer. The paper had glanced at the improved comforts of the workpeople of Nottingham, and he (the chairman) could bear his testimony in saying that there was hardly any provincial town in England that was more rapidly acquiring an architecture of its own. These were most cheering facts, taken in connection with the production of articles of elegance, which were brought to a price within the means of all. How far the ladies would agree that the Nottingham machine-lace rivalled the more costly productions of Valenciennes, he could not say; and perhaps they had better not enter upon the question whether they thought it right to encumber their garments with innumerable yards of machine-wrought lace, as the ladies were in the habit of doing with the real Belgian and French laces, but he thought it probable that ladies might bring their minds to adopt the Nottingham lace, and that it would, to a certain extent, supplant the Valenciennes manufactures.

Mr. Felkin.—Not supplant it. He believed there never was a period when pillow lace was more used than at the present time. Buckinghamshire suffered for a time; but the lace manufacture of that county was now in a better condition than it was previous to the introduction of the machine-wrought lace.

The Chairman added, that these were important facts to be reflected upon, inasmuch as they were apt to be apprehensive that progressive advantages operated unfavourably upon antecedent advantages. There was one point alluded to in the paper on which he felt great interest—that was the suggested establishment of a historical museum of the lace trade. They had evidence of a similar design in Manchester, where it was contemplated to collect the progressive memorials of the cotton trade by means of a museum, to represent the history of that branch of national industry. There were numerous other trades which might be represented in the same way; and he thought the time was coming when there would be a better appreciation of the interesting records of the past; and, looking to the future, they might hope for the establishment of a trade museum, which this Society had greatly aided in commencing. Such a museum, he thought, this country, of all others, ought to possess; and yet, up to this time, they had been the most backward in that respect of any nation. They were too much addicted, he thought, to the notion that every one must do his own work as he pleased, rather than associate for the purposes of grand and combined undertakings. He thought that national principle—so to term it—was carried a little too far; and he thought some relaxation in this respect would be alike advantageous to individuals and the community at large; by which means they would be enabled to rival the magnificent productions of science and art displayed in other countries, where there was for this purpose a somewhat more despotic action than they had in this country. He hoped the time was coming when they would have an historical museum, representing not only the lace trade, but also all the other manufactures of the country. It now only remained for him to call upon some gentleman to propose a vote of thanks to Mr. Felkin for his valuable and interesting paper; and he thought he could not do better than request that task to be undertaken by the Rev. Mr. Rigg, of Chester, who deeply sympathised with the efforts of the Nottingham lacemaker, and with the admirable way in which their labours had been recorded by Mr. Felkin.

The Rev. Mr. Rigg said, he had attended merely as a listener, without any intention of offering any observation upon a subject which he had heard with so much interest. Much valuable instruction might be gathered from this paper, and perhaps no one was more competent than Mr. Felkin to deal with the difficulties of those inventors who had been described as displaying "much genius and little science." Hence the production of machines, wonderful in their construction, but useless, in consequence of the extraordinary ingenuity displayed upon them. The consequence was, they had the tailor, the shoemaker, the publican, and the butcher, all engaged in the invention of this machinery. He thought, if there was one duty which it was more incumbent upon the government to discharge than another, it was to afford to those self-taught men the means of promoting their scientific instruction. Had that been the case they would not have the fact recorded, that they had done much for the trade, whilst they themselves were involved in poverty and want—occupying a pauper's grave, while all around had been benefited by their ingenuity and talent. Had the men who invented these various machines had the same means of obtaining a knowledge of science as they had for improvement in design, no doubt the machinery itself might have been greatly simplified, and, consequently, less capital would have been involved. They might have had equally good productions at still more extraordinarily low prices. Unless they promoted the scientific education of the people, they must expect to be left behind in the race of competition. The Schools of Art in the present day were doing all that could be expected of them, and if they would do as much for promoting the study of science as had been done in the study of design, Nottingham and Manchester would be amongst the first places to be benefitted. He begged to propose a vote of thanks to Mr. Felkin for his valuable and instructive paper, and expressed a hope that that gentleman would favour the Society on a future occasion with further details of the progressive history of this branch of national industry.

The vote of thanks having been unanimously accorded,

Mr. **Felkin**, in acknowledging the vote of thanks, expressed his willingness to communicate all he could to the Society, and, through its publications, to the world at large, as to what was transpiring in Nottingham with regard to its staple manufacture. He felt very grateful to the meeting for the patience with which they had listened to details, dry in themselves, but still he hoped not devoid of interest to those who were acquainted with the labour and burdens which had attended the progress of the lace manufacture. Competition was daily increasing, and demanded the utmost energy on the part of those who wished to make their way successfully. The little trifling piece of lace he held in his hand cost a man's life. Having succeeded in producing it, the poor man hung himself as the consequence of an overwrought mind. They little knew of the wear and tear of the human mind attendant upon even partial success in the construction of such machinery as they saw before them, whilst failure often led to ruin and despair. This was a proof of the necessity for scientific as well as artistic progress in manufactures. Had scientific instruction been carried to the extent desired by Mr. Rigg, in Nottingham, Mr. Heathcoat would not have put 60 motions in his machine when six would answer all the purposes required, but he would have been aware of the readiest mode of applying the materials which he found or invented. It had been so in the history of all self-instructed mechanicians, who had too often gone over the same ground as had been unsuccessfully travelled by those who sought to improve machinery. What had been the result? An enormous outlay of capital in the shape of perfectly useless patents—worse than useless—for they often stood in the way of the free use of the mind, and hands, and capital of those engaged in the trade. A proper education as to the best methods of applying machinery would have resulted in the saving of hundreds of thousands of pounds in Nottingham alone during the last few years. He was, however, gratified with the hope that the town he represented on this occasion had not come out of his hands in a worse condition than it was previously to his obtruding this paper upon the attention of the Society.

The Secretary announced that the Paper to be read on the evening of Wednesday next, the 4th of June was "On Brickmaking by Machinery," by Mr. Humphrey Chamberlain."

STATE AID IN FORMING LOCAL MUSEUMS OF ART.

A change has been made recently in the mode of examining the works of the Schools of Art, which is of a self-acting character, and calculated to assist materially in forming local Museums of Art. Heretofore, there have been two annual exhibitions in London for the purpose of inspecting the works and rewarding the students of the metropolitan and provincial schools. This course was attended with two defects—1st, *all* the works of the various schools were never inspected together; and 2ndly, there was no sufficient mode of testing the student's knowledge of geometry, mechanical drawing, perspective, and model drawing. Moreover, the great increase of Schools of Art throughout the kingdom, and also the number of students attending them, necessitate changes in the mode of inspection. It has been determined, therefore, that once in each year an inspector from the department shall visit each School of Art, and shall hold an examination in certain of the early stages of the course; and at the same time, in conjunction with the head-master of the school, and assisted, if necessary, by a head-master from one of the nearest Schools of Arts, adjudge local medals and rewards. The principal and advanced works rewarded with a medal, will be sent to form a general or national collective exhibition, either in some one of the great provincial towns, or the metropolis; and will be inspected by the art superintendent, who, in concert with examiners appointed by the board, will adjudge national medals to the best works from all schools in competition with each other. The collection will afterwards be sent round to some of the larger provincial towns. The whole number of local medals that can be awarded in any school will not exceed thirty, and in any one stage or section may not exceed three. The works which have obtained first medals in the local competitions, being all collectively exhibited, will be examined by the art superintendent, aided by other appointed examiners, and medals awarded to the works successful in this second competition. These medals can in no case exceed 100 in number for all the schools for the year 1856-7, but the number up to this maximum will be regulated by the excellence of the collective works. For every medal awarded in the National competition, the School of Art in which the successful student who obtained the medal was under instruction, will have the privilege of selecting from a list, works of art of the value of £10. The result to every school will, therefore, be proportioned to the advance of the students, and it will be by such means that the nucleus of a local museum may be established.

The feature of this plan is, that each local school shares in the distribution of state assistance, absolutely according to merits. The central authority, instead of assuming the position of being the judge of the amount of assistance, as formerly, will now become merely the executive of the self-acting demands of each local school.

Home Correspondence.

TONNAGE REGISTRATION.

Woolwich Dockyard, 27th May, 1856.

Sir,—I request the favour of your inserting, in the *Journal of the Society of Arts*, the following communication, which I have addressed to the Editor of the *Mechanics' Magazine*, in reply to a critique which has appeared in Nos. 1,705-6-7-8-10 of the *Mechanics' Magazine*, on my paper on Tonnage Registration, read before the Society of Arts on the 16th January last.

I am, &c.,
CHARLES ATHERTON.

To the Editor of the "Mechanics' Magazine."

Woolwich Dockyard, 27th May, 1856.

Sir,—My attention having been directed to the *Mechanics' Magazine*, Nos. 1,705-6-7-8-10, containing a review of the paper on "Tonnage Registration," read by me before the Society of Arts, London, on the 16th

January last, I am glad to find that you regard the subject worthy of being brought before the attention of the numerous readers of the *Mechanics' Magazine;* indeed, there can be no question that the public generally, who, as consumers, pay the whole cost of production and delivery of the goods consumed, including freight and maritime insurance (the value insured being said to be no less than 600 millions per annum), are deeply interested in shipping registration being made duly effective for promoting safety at sea, and all other objects, both mercantile and scientific, conducive to maritime transport economy.

With reference to my paper on "Tonnage Registration," as published in the *Journal of the Society of Arts* for the 18th January, 1856, but which I regret did not appear in the *Mechanics' Magazine* previously to the publication of your review thereon, the first point now requiring attention on my part is to disabuse the minds of your readers as to the inferences and gratuitously assumed conclusions which your review, in common with others who have taken part in this discussion, have been pleased to represent as the purport of my paper; hence, misstating my case, and attributing conclusions to me which I disavow. For instance, by my paper I did not object to internal roomage as one element of tonnage registration; but I upheld it as indispensable to a complete system of registration, suggesting, however, in addition, that shipping registration ought to record the capability of ships for carrying weight of cargo with reference to some *limitation* of draught, and that the actual draught at which ships leave port ought to be officially recorded, for the purpose of affording some check on the overloading of ships, by rendering legal proof on this vital point available in the case of judicial inquiry as to the cause of wreck and loss of life, or damage to property at sea. These are the suggestions which constitute substantially the sum total of my imputed "condemnatory harangue" against the Merchant Shipping Law of "1854." It has been to gloss over my expositions of these deficiencies of the law, and thus counteract the proposed amendment of the law, that I am dignified as the Coryphœus of agitators against the law. This, in reality, is Mr. Atherton's "attack on the shipping interest, which has given such dire offence;" but I beg to apprise the readers of your review that I regard all the imputed personalities which have been laid to my charge as mere delusion, put forth to divert attention from my exposition of the fact that our present system of shipping registration affords no certain or even comparative measure of the tons weight of cargo that ships will safely carry; nor does it afford any direct check to the unsafe loading of ships, or prescribe that any official record be taken of the draught at which ships leave port, to be received as evidence in the case of judicial inquiry as to the cause of wreck or damage of cargo at sea. Such are the deficiencies of the Act of "1854;" and if a law be not effective for the checking of abuse, it is sure to be effective for the cloaking of abuse, and, consequently, conducive to the propagation of abuse; and these, I maintain, are the characteristic features of the Merchant Shipping Act of 1854, as respects Part 2, on the measurement and registration of shipping. Again, in judging of my expressions with respect to their personal application, some attention ought to be paid to the distinction whether I am the originator of an argument, or the constrained respondent to an argument. Be it observed, that in bringing forward the question of Tonnage Registration before the Society of Arts, I did not originate, but I had to meet, the argument which had been previously advanced in support of the Merchant Shipping Act of "1854," to the effect that that Act ought not to be questioned or impugned, because the shipping interests had declared themselves satisfied with the Act as it is, and had not put forward any petition to the legislature for the amendment of the tonnage registration clauses. It was to meet this singular doctrine—most convenient as respects class legislation once achieved, but monstrous as respects permanent public interests—that I challenged precedents, in language which your review is pleased to compliment (p. 343) as "Mr. Atherton's indignant eloquence, all very fine, but quite beside the question," to refute the allegation that no chartered institution, public trust, or corporate body of any kind, whether political, mercantile, or professional, has ever yet been known, voluntarily, to originate self-corrective reformation, at a sacrifice to its own exclusive and once legalised or prescriptively usurped immunities, privileges, powers, or profits, purely for the sake of public good. Hence, I ventured to remark that we have no right to expect that the shipping interests should, in these days, and as times go, all at once become purists *par excellence*, and constitute themselves the exception to the general rule. Here was an insult to the shipping interests! How have I in consequence been charged with slander, and put on my defence! But I need not further plead my own cause, for your review itself briefly sums up this little episode in the following words, page 340:—

"Mr. Atherton's assault provoked one or two replies from shipowners, who felt their craft insulted by some of his remarks, showing a sensibility on the occasion which would go far with some people to prove the truth of those imputations they are so ready to extract from Mr. Atherton's words." Your review further observes, page 342, "We do not think Mr. Atherton meant to make any serious charge against the shipping interests." I thank your review for this remark, as showing your own impressions on reading my paper, but I cannot accept the proffered defence as to my not having *meant* to make any serious charge, and offer so meagre an apology, if any be due, for I always try to write as nearly as may be what I mean. I deny *in toto* that my writing admits of any personally offensive construction. I addressed myself to a system of public registration, which I regard not merely as deficient for good purposes, but delusive and mischievous in its immediate effects on public interests, and I denounced it as such; but immediately on finding that my exposition of the deficiences of our system of tonnage registration had been diverted into a charge of personal defamation, I took an early opportunity in the course of this discussion of publishing as follows:—

"Can it be said that there is any sentence in my paper unbecoming, and not fairly within the bounds of argumentative propriety? If such be the opinion of the Council of the Society of Arts, or of the Chairman of the meeting at which my paper was read, I regret it, and I claim the privilege of retracting it." Here, again, I meant what I wrote.

Now to return to our subject.

In suggesting that Tonnage Registration ought to embrace the capabilities of ships respectively for carrying weight of cargo as distinguished from roomage for cargo, I anticipated being met by that hackneyed argumentative stopper, "Impossible!" by remarking that the capability of a ship for carrying weight would be deducible from the displacement contained between the actual water-line, or plane of flotation of the ship when light, ready to receive her cargo, as given by the ship herself, and the load-line limit of draught for which the ship may have been designed by its constructor, or which may be officially assigned to her, showing also, at the same time, by reference to the catalogues in Fincham's Naval Architecture, pages 248, 267, 321 to 327, and 405 to 410, that ships of all classes, both naval and mercantile, sailing ships and steamers, are constructed, and their capabilities for carrying weight are calculated by British, French, Russian, and Swedish shipbuilders with reference to a determinate deep draught line, which limit of draught or load line is, in the hundreds of ships tabulated by Fincham, specified and recorded in feet and inches fore and aft as the contemplated limit of the loading. Still this reference to, and recital of, Fincham's catalogues in proof of the practicability of officially assigning a load-line limit to every ship, is quietly ignored by all who have taken part in this discussion. Fincham's catalogues, though thus pointedly adduced by me, are not even noticed in your review of my paper, and thus the suggestion for registration of the capabilities of ships for carrying weight with reference to the deep draught limit assigned by the constructor, has (Fincham's catalogues notwithstanding) been simply denounced by some as "impossible," and avoided by others with silence.

Your review is, however, constrained to acknowledge, and at the same time to palliate, the fact of the insufficiency of the law of 1854, in the following terms (page 341):—

"The tonnage measurement and registration of vessels has never been fairly brought before government in any other than a purely fiscal point of view. Mr. Atherton is the first agitator that we know of who has insisted upon the scientific features of the case, and those which bear upon the dangers of the sea voyage."

Again, at page 343, your review admits as follows:—

"Undoubtedly it would be very desirable, if possible, to fix a limit to the degree to which ships may be loaded."

And again:—

"There is undoubtedly a point beyond which ships cannot be safely loaded."

These acknowledgments completely establish the fact of the existing deficiencies of the law on which I have based my paper and suggested specific remedies. Your review admits the grounds on which "Coryphæus" the agitator has based his "condemnatory harangue;" and although your review sets up the defence that "the tonnage measurement and registration of vessels has never been fairly brought before Government in any other than a purely fiscal point of view," you all at once abandon that explanation, and affirm that the system of admeasurement prescribed by the Act does effect all the objects of complete registration, for, at page 342, we read as follows:—

"Of this, however, we are satisfied that if a shipowner stipulate for a ship whose registered tonnage shall be 1,000, he need be under no apprehension as to its capabilities of carrying 1,000 tons weight or 1,000 tons of measurement of light cargo at the usual conventional measurement of 40 cubic feet to a ton."

Now, on this point, I join issue with your review. My challenge of the registration is this, that internal roomage, measuring, as prescribed by the Act of 1854, up to the deck, without reference to any plane of flotation at which the ship may put to sea, affords no guarantee or measure as to the actual or even to the proportional tons weight of cargo that ships as floating vessels, not submerged catamarans, will carry. Some ships of 1,000 tons register, that is 100,000 cubic feet internal roomage, may safely, so far as flotation is concerned, be loaded with 1,500 tons weight of cargo, and in addition thereto 1,500 tons by measurement of light cargo at 40 cubic feet to a ton, being altogether 3,000 tons of cargo or three times the amount of the register tonnage chargeable for freight, whilst other ships of 1,000 tons register may be loaded to the utmost limit of safety with only 500 tons of cargo on board or only half the register tonnage. As for steamers, I see no limit to the possible ratio between their register tonnage and their capability for weight cargo. Thus we may have two ships of the same register tonnage, say 1,000 tons, one of them may be loaded with 3,000 tons of mixed cargo for freight, whilst the other may not be capable of safely carrying more than 500 tons weight of cargo, yet your review informs us (No. 1706, page 368) that the present system of tonnage registration has been "enacted with the sole view of levying tolls fairly." Your review calls upon me to name the ships that will substantiate my statements. I decline thus to show up the shipping of any individual, and I should have supposed that the case of the *John*, with which in this discussion I was so perservingly taunted, might have satisfied you as to the unfairness of thus tampering with private interests in matters of public discussion. Shipowners have a just right to keep to themselves, if they so please, all the mysteries of their craft not exacted of them by the requirements of the law; but if your review be-over-exacting in this subject, the records of the transport service during the late war will doubtless afford much statistical information on this subject. The obvious explanation of the above asserted discrepancies is that ships cannot be immersed up to the very deck to which the registered tonnage is measured, and thus put to sea with the deck awash in smooth water. Ships at sea are commonly liable to lie over as much as 30°. I do not pretend to dictate the maximum or minimum angle for which provision should be made. If, however, we assume not 30° but 18° only as the maximum safe lie-over of the ship, then in this case the load line limit of the ship in smooth water would be at the distance of one-sixth part of the beam below the deck amidships, and the number of tons weight, including the weight of the ship itself and its equipment, that would be required to immerse the ship down to this assumed load-line, namely, one-sixth part of the beam below the deck, will depend on the proportion which the *immersed* portion of the ship bears to the portion not immersed, that is, on the proportions of length, breadth, and depth and character of the lines to which the ship of, say a 1,000 tons register, may have been constructed. In fact, the principle of basing tonnage admeasurement on the entire internal roomage, measuring up to the deck, above the plane of flotation at which vessels can safely go to sea, does not fulfil the conditions set forth by your review in the quotation above referred to as guaranteeing any definite capability for carrying weight based on the register tonnage. The doctrine thus asserted by your review, namely, that the displacement or capability of ships for weight-cargo is closely proportional to their internal roomage, is based, in the first place, on the untenable assumption of a proportional scale of scantling, or build; and even in the case of proportional build, it only holds good with ships sunk or water-logged, deck awash, full, may be, of dead men's bones—a precious condition of things for constituting the only base of tonnage registration—a precious price at which to purchase the equity in levying tolls before referred to, possibly liable to vary, in ships of the same registered tonnage, in the proportion of thirty to five, if charged against their tonnage of freight cargo.

As regards the practical operation of this new system of tonnage admeasurement tending, as your review asserts, to remove the obstacles to improvement which existed under the old system of builders' measurement, all the evils of which system your review is pleased to say would be continued by adopting the system of registration suggested by my paper, I beg to observe, in the first place, that my proposed system of tonnage admeasurement and registration does not supersede the internal measurement prescribed by the law of "1854," and which your review holds up as the panacea of all evils, but adopts it as giving the capability of ships for carrying a definite quantity by measure, provided that the said quantity be not so heavy as to sink the ship, and, to check the occurrence of such a catastrophe, I propose that the registration embrace the capability of the ship for carrying weight; and to prevent abuse in this respect, in defiance of the registration, I have suggested that the draught at which ships leave port be officially recorded by some person not interested in the loading of the ship. How these additions to our registration can mar or neutralise the efficacy which your review attaches to the roomage registration alone, I cannot discern. I, however, do perceive that this system of registration and record, so "un-English, tyrannical, and inquisitorial," would afford evidence whereby the cause of wreck might be judicially scrutinised more closely than is possible under the restricted registration prescribed by the Act of "1854," especially as respects the question, whether such wreck may be attributable to causes for which the owners or charterers may be held pecuniarily responsible, or to causes for which the parties in charge of navigating the ship are responsible by imprisonment, or such-like non-pecuniary but personal punishment. What signify penalties imposed by law on proof of fault, if the same law, by the insufficiency of its enactments, obstructs all proof, as is the case with the Merchant Shipping Act of "1854," touching the loading of ships. On this point, also, your review, although verbosely condemnatory of my paper, is constrained to make the following concession (page 343):—

"In case of accident, and the consequent inquires instituted by the Board of Trade, the circumstance [overloading] proved legally in evidence by persons conversant in these matters, should have its due weight, and remove the accident from the category of those over which the owners have no control. Let the Board of Trade have, if it so please, properly authorised officers to note and record these facts."

Coming events cast their shadows before.

Now, really, after these concessions on the part of your review, so substantially confirmatory of my paper, I may leave to be disposed of by the winds all the mere assertions and utterly unfounded and inapplicable popular plausibilities about the baneful effects of government interference, which constitute so large a portion of your review, as published in Nos. 1705 and 1706 of the *Mechanics' Magazine*.

I will, however, add a few words on the type of ships, as affected by the law, and also dispose of the measurement or mode of measurement question to which your review has so copiously directed attention in Nos. 1707, 1708, and 1710 of the *Mechanics' Magazine*.

On the type of ships as affected by the law of admeasurement, it is questionable whether the admitted improved type of shipping, which of late years has been gradually introduced, is attributable to any changes which have been made in the law of Tonnage Admeasurement and Registration. So far as the builders were concerned, their pecuniary interest was, under the old law, decidedly opposed to the production of the deep and bluff type that formerly prevailed, for by the old law of tonnage measurement the builder's payment was based on length and midship breadth only; his interest, therefore, was to build as shallow and as sharp a ship as he could induce the shipowner to accept, but the interest of the shipowner, on the contrary, was to get as burthensome a ship as he could for his money, or a ship deep and bluff, so as to carry a large cargo in proportion to the nominal tonnage. Thus, under the old law the interest of the builder was in opposition to the production of the old deep and bluff type. The cupidity of shipowners thus to retain control over the builders, and get an indefinitely burthensome ship under a limited nominal tonnage, has been one of the causes why the old law of builders' tonnage, which was repealed in 1833, has continued up to the present time (1856) to be generally upheld as the base of building contracts. Of late years, however, competition in trade, especially as respects steamers *versus* sailing vessels, has enforced an improved type of build; but if the register tonnage based on internal measurement under the law of 1854 should now be recognised as the base of building contracts, it will then only be by the deep loading of ships, thus encroaching on safety, that the cupidity of shipowners and ship-charterers to carry the heaviest possible cargo in proportion to the registered tonnage will be gratified. Hence the necessity for registering the limitation of weight which the loading ought not to exceed.

As respects the *mode* of measurement, I regard this as a question of detail, and I have already published my views thereon, as follow:—

"I do not take credit to myself for having devised any new mode of admeasurement; I have merely suggested that as ship-builders generally object to their lines being taken off, and their peculiar type of form ascertained in a manner which admits of its being appropriated or pirated by others, as is done in the system of measurement prescribed by the law of 1854, if these objections on the part of builders be held to be reasonable, I have suggested that we may approximate very closely to the required cubical capacities of ships, both externally and internally, by adopting the principle of the French system, namely, taking cognisance of the three dimensions, length, breadth, and depth, and correcting the cubical product by a factor, the said factor to be either a medium constant quantity, or be subjected to a prescribed scale of variation to meet extreme cases as may be determined. If, however, the objections of builders to the exact taking off the lines of their ships be overruled for the public good in this case, I do not hesitate to bring before the notice of any committee that may be appointed to investigate this question, that the system of shipping admeasurement originally adopted in 1829 by Mr. James Peake, a shipwright officer in her Majesty's service, and practised by him since that date, is a system preferable to that which is prescribed under the Act of 1854. Any two really scientific systems of admeasurement, such as Sterling's rule and Peake's rule, will produce closely identical results. It, is, therefore, not so much on the score of superior accuracy as on the score of superior applicability and facility of being mentally understood by the operator, that Peake's system is to be preferred."

As regards Peake's rule, it includes a closely approximate measurement of the curved spaces, whether convex or concave, by which the real form of a ship between the extremities of the ordinates of measurement differ from the straight line, whereas, by Sterling's rule no notice whatever is taken of the curved portions above referred to; Peake's system is, therefore, the more correct of the two. A further advantage of Peake's rule is that the sections of the vessel may be taken at any parts most conveniently accessible, and not necessarily equidistant; whereas, by Sterling's rule it is essential that the ordinates of the respective sections be equidistant, and that the sections themselves be equidistant from each other.

In regard to Sterling's rule, as your review in Nos. 1,707, 1,708, and 1,710 of the *Mechanics' Magazine* elaborately expounds the *rationale* of Sterling's rule, for the edification of the numerous readers of that useful and deservedly popular periodical, arriving at the following conclusion:—"The wonder is, that a rule for the calculation of the cubical contents of an irregular solid is capable of so satisfactory and simple explanation;" and as I have no more desire to depreciate Sterling's rule than I have to depreciate any other mathematical exposition, I will not say one word in question of the congratulation with which your review greets the readers of the *Mechanics' Magazine* on the subject of your exposition of Sterling's rule as the base of the rule for tonnage measurement under the Act of 1854.

The modes of approximately measuring a ship admit of several variations; but I regard the mode of measurement as a mere matter of detail, not affecting the vitals of the Act of "1854," although it is the point to which your review, after having substantially admitted the deficiencies of the law which constitute the subject matter of my exposition, has almost exclusively directed attention, in Nos. 1,705-6-7-8-10, of the *Mechanics' Magazine*.

I am, &c.,
CHARLES ATHERTON.

Proceedings of Institutions.

Blackburn.—From the thirteenth annual report of the Directors of the Literary, Scientific, and Mechanics' Institution, it appears that the number of members has varied considerably during the four quarters, having been respectively, 420; 398, 474, and 452. The attendance upon the various classes is stated to have been, on the whole, highly satisfactory. The numbers in each during the last quarter were: Writing and arithmetic, 113; grammar, 51; reading, 62; geography, 39; female class, 10. It is in contemplation to establish a drawing class. During the season sixteen gratuitous lectures were delivered, and the Directors congratulate the members on their success. The reading-room is amply supplied with various daily and weekly newspapers, as well as serials. Owing to a handsome balance at the end of the last year, the Directors have been enabled to add 1,065 volumes to the library by purchase, and 50 volumes have been presented. The number of volumes taken out for reading during the four quarters has been as follows, 865, 1008, 1901, and 2350, making a total of 6,124. The number of readers has been 208, 216, 291, and 306. The subscriptions during the year amounted to £281 5s. 6d.; other receipts to £15 6s. 8d. There is a balance in hand of £94 3s. 8d.

KENDAL.—The thirty-second annual report of the Mechanics' Institute states that a large increase has taken place in the attendance at the news-room, and the loans from the library have amounted to 1,987 volumes, being an increase of one-tenth over those of last year. There have been added to the library during the year 24 volumes, 19 by purchase and 5 by donation. The number of members and subscribers now amounts to 136. The report refers to an excursion trip to Lancaster and Furness Abbey, of which about 170 members and friends availed themselves. It then speaks of a *soirée* held in the winter, which was not numerously attended, and says that various causes conspired to prevent the arranging of a winter course of lectures, as in former years. The endeavours of the committee have been diligently turned to the establishment of classes; that for French continues to make steady progress. The drawing class numbers 10 members, and the teacher reports very favourably of their progress.

YEOVIL.—The annual report of the committee of management of the Mutual Improvement Society states that since the last meeting they have been engaged in raising funds for purchasing a new building. It seems that £464 3s. 0d. has been raised by donations, and £400 by £5 shares, the latter secured on mortgage of the building, at 5 per cent. interest. The number of members has increased from 207 to 454, and the issues from the library from 616 to 1,873. The library has been increased by the purchase of 58 volumes, and 34 volumes by donation. During the winter a lecture was delivered every week, and the result was in every respect satisfactory.

To Correspondents.

ERRATUM.—In last No., p. 460, col. 2, line 16 from bottom, for Bentley, *Richard*, read Bentley, *Professor Robert*.

Letters have been received from Mr. F. Braithwaite and Mr. S. C. Homersham, on the Water Question, but their publication is unavoidably deferred for want of space.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 10th, 15th, 16th, 17th, and 19th May, 1856.

Par. No.
160. Naval and Military Accounts—Reports and Treasury Minutes
193. Thames Embankment, &c.—Copy of Reports.
201. Fire Insurance—Account.
217. New Churches—Account.
196. Mercantile Marine Fund—Account.
189. Exchequer—Account.
206. Commissariat Chest—Account.
170. Turnpike Trusts (Ireland)—Statements of Income and Expenditure.
209. Loan Societies—Abstract of Accounts.
202. Poor Law—Copies of Report and Correspondence.
214. Spirits—Returns.
168. East India (Revenues)—Account.
120. Bills—Court of Exchequer (Scotland).
126. Bills—Registration of Voters (Scotland).
132. Bills—Registration of Leases (Scotland).
Railways (Number of Passengers)—Return.
Turnpike Trusts—6th Report by the Secretary of State.

Delivered on 20th May, 1856.

122. Shipping—Returns.
181. Mr. Brownrigg—Copies of Additional Despatches.
194. Coals, Cinders, and Culm, &c.—Account.
110. Bill—Grand Juries (Ireland).
Oude—Papers relating to.

Delivered on 21st May, 1856.

90. Civil Services Estimates—General Abstract.
210. Foreign Sugar—Account.
212. Poor Law—Return.
223. Civil Services Estimates—Class 8.

Delivered on 22nd May, 1856.

212. Poor Law—Return (a Corrected Leaf).
133. Bill—Juvenile Offenders (Ireland) (Amended).

Delivered on 23rd May, 1856.

229. Fireworks, Hyde-park, &c.)—Copy of Correspondence.)
134. Bills—Dissenters' Marriages (as Amended in Committee, on Re-Commitment, and on Second Re-Commitment.)
136. Joint-Stock Companies Winding-up Acts Amendment.

Delivered on 24th and 26th May, 1856.

198. Ordnance Survey of Scotland—Report from Committee.
224. British Spirits—Return.
206. Public Prosecutors—Report from the Committee.
221. Public Libraries—Returns.
211. Statute Law Commission—Copy of the Memorandum of the Attorney-General.
225. Foreign Shipping—Account.
226. Army—Return.
227. Mortars and Guns—Return.
174. Ecclesiastical Commission—First Report from the Committee.
122. Bills—Judicial Procedure, &c. (Scotland).
131. Bills—Courts of Common Law (Ireland) (as Amended in Committee, and on Re-commitment).

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 2, General Monthly Meeting.
Architects, 8, Mr. R. Dennis Chantrell, "On the Domestic Brick Buildings of the Sixteenth Century in Bruges and other places in Belgium."
Chemical, 8, 1. Mr. R. Adie, "On some Experiments with Thermo-Electric Joints." 2. Mr. F. Field, "On the Action of Heat upon Oxichloride of Copper." 3. Professor Abel, "On the Composition of some Foreign Varieties of Iron."
Entomological, 8.
TUES. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Linnean, 8.
WED. London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. Humphrey Chamberlain, "On the Manufacture of Bricks by Machinery."
Geological, 8, 1. Mr. Plant, "On the Keuper of Leicester." 2. The Rev. Mr. Brodie, "On the Keuper of Warwick." 3. Mr. Salter, "On Diploceras, a new Genus of Cephalopoda." 4. Mr. Woodward, "On an Orthoceras, from China."
THURS. Royal Inst., 3, Prof. Tyndall, "On Light."
Zoological, 3.
Antiquaries, 8.
Photographic, 8.
FRI. Botanical, 8.
Royal Inst., 8½, Prof. Tyndall, "Comparative View of the Cleavage of Crystals and Slate Rocks."
SAT. Asiatic, 2.
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Asiatic, 8½, Lieut.-Gen. Briggs, "On the Organisation of the Armies of India under the Native Princes."

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May 23rd*, 1856.]

Dated 4th April, 1856.

820. Joseph Gilbert Martien, Newark, New Jersey, U.S.—Improvements in the manufacture of iron.

Dated 24th April, 1856.

980. Alexander Southwood Stocker, 11, Poultry, Cheapside—Improvements in the application of certain materials to the manufacture of ink and other stands, and other articles, and in the manufacture and finishing of articles produced out of such or other material or materials.

Dated 25th April, 1856.

992. George Elliot and William Watson Pattinson, Newcastle-on-Tyne—Improvements in the production of peroxide of manganese.

Dated 7th May, 1856.

1069. John Furnevall, Haslingden—Improvements in the construction of valves.

1070. George Martin, 6, Windmill-terrace, Camberwell, and Alfred Lodwick Newman, New Church-street, Bermondsey—Improvements in freeing or purifying animal fibres from admixture with vegetable matters.
1071. William Joseph Curtis, 1, Sebbon-street, Islington—Improvements in carriages to run on rail or tramways and common roads.
1072. Ralph Heaton, jun., Harry Heaton, and George Heaton, Birmingham—Improved manufacture of balance weights used for counterbalancing pendant lamps and chandeliers, and for other like purposes.
1073. Samuel Alexander Bell and John Black, Bow-lane—Improved method of, and preparation for, igniting matches.
1074. Jean Périnaud, Paris—Improvements in preparing or dressing silks.
1075. Robert Royds, Southampton—Improvements in the manufacture of soap.

Dated 8*th May*, 1856.

1076. Louis Guillaume Perreaux, 16, Rue M. le Prince, Paris—Improved valve.
1077. Charles Schneider and Frederick Leiss, Hesse Darmstadt—Manufacturing a safety boiling apparatus.
1078. Louis Fréderic Mayer, 133, Regent-street—Improvements in photography.
1079. Alexander Ebenezer Riddle, 33, Walbrook, and Isaac Hoare Boyd, 3½, Mansion-house-place—Improvements in tanning by machinery and chemicals. (A communication.)
1080. James Niven, Keir, N.B.—Improvements in the manufacture of paper, and in the production of textile materials.
1081. James Gray Lawrie, Glasgow—Improvements in steam engines.
1082. Jonathan Amory, Boston, U.S.—Improvements in furnaces for locomotive and other steam boilers, which improvements are applicable to reverberatory and puddling furnaces, and to furnaces for heating buildings.
1083. Conrad William Finzel, Bristol, William Needham, Smallbury-green, Middlesex, and John Barton, Shoe-lane—Improvements in apparatus for filtering sugar and saccharine juices.
1084. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for felting or sizing hat bodies. (A communication.)
1086. William Edward Newton, 66, Chancery-lane—Improved machinery for cutting, punching, and forging, or swaging nuts or washers. (A communication.)
1087. Alexander Charles Louis Devaux, King William-street—Improvements in the construction of granaries.
1088. Alfred Vincent Newton, 66, Chancery-lane—Improved construction of rotary pump. (A communication.)
1089. Alfred Vincent Newton, 66, Chancery-lane—Improvement in bands for securing bales of goods, and for other like uses. (A communication.)
1090. Stephen Walter Underhill, Wellfield-cottage, Dunse, Berwickshire—The preservation of life in cases of shipwreck or other casualty at sea, the Buoyant Cushion.

Dated 9*th May*, 1856.

1091. Léon Louis Jardin and Joseph Biamond, 39, Rue de l'Echiquier, Paris—Improvements in engraving on stone, earthenware, china, and glass, and also in ornamenting the same.
1092. William Bayliss, Wolverhampton—Improvements in chains for collieries, cables, and other purposes.
1093. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in carding engines for carding cotton and other fibrous materials. (A communication.)
1094. John Wesley Hackworth, Priestgate Engine Works, Darlington—Improvements in machinery or apparatus for raising and lowering heavy bodies.
1095. Ferdinand Potts and Thomas Vann, Birmingham—Machinery for ornamenting, floating, burnishing, and polishing metallic tubes, part of which machinery is also applicable for performing the like operation upon other metallic surfaces.
1096. Edward Daniel Johnson, Wilmington-square—Improved mode of mounting marine chronometers.
1097. George Jordan Firman, Newton-le-Willows, Lancashire—Improvements in the manufacture of sulphuric, tartaric, citric, and oxalic acids, ammonia, and cyanides.
1099. William Basford, 16, Talbot-road, Kentish-town—Improvements in apparatus for purifying coal gas.
1100. Louis Beauché, Offenbach, near Frankfort-on-the-Maine—A machine for the manufacture of cigars.
1101. George Simpson, Leather-lane—Improvements in rotary knife-cleaning machines.
1102. Richard Archibald Brooman, 166, Fleet-street—Improvement in cranes. (A communication.)
1103. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for the manufacture or finishing of tyres, hoops, and rings. (A communication.)

Dated 10*th May*, 1856.

1105. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for manufacturing tubes and pipes, applicable also to the rolling of rods and bars. (A communication.)
1107. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for cutting irregular forms. (A communication.)
1108. James Wallace, jun., Glasgow—Improvements in preparing, bleaching, washing, cleansing, and drying textile fabrics and materials and pulpy substances.
1109. Robert Wotherspoon, Glasgow—Improvements in hats and other coverings for the head.
1110. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in drying leather and dressed skins. (A communication.)
1111. John Ridal, Sheffield—Improvements in spring knife handles.
1112. William Burkin, Neate-street, Old Kent-road—Improved machinery for manufacturing painted cloths.
1113. Bartholomew Beniowski, Bow-street, Covent-garden—Improvements in typographical composition, and in the manufacture of logotypes to be used therein.

Dated 12*th May*, 1856.

1114. Charles Frederick Claus, Latchford, Chester—Moistening land, streets, and the better extinction of fires.
1115. Pierre Ernest Aimont—Improvements in manufacturing shoes and other coverings for the foot.
1116. Richard Whytock, Edinburgh—Improvements in apparatus to facilitate the printing of yarns or threads.
1117. Edouard Besnier de la Pontonerie, Paris—Improvements in the apparatus for consuming smoke. (A communication.)
1118. Barnett Samuel, Sheffield—Improvements in the manufacture of combs.
1119. William Edward Newton, 66, Chancery-lane—Improvements in machinery for pumping and forcing water and other fluids. (A communication.)
1120. William Edward Newton, 66, Chancery-lane—Improved machinery for splitting or cutting blocks of wood, for match splints, kindling wood, trenails, and other purposes. (A communication.)

Dated 13*th May*, 1856.

1121. Charles Butler Clough, Llwyn Offa—Improvements in elongating and contracting metal bars or rods for the obtainment of motive power.
1125. Alexander Parkes, Birmingham—Improvement in preparing materials for and in waterproofing and coating woven and other fabrics, paper, leather, and other substances.
1127. Robert Raywood, Penistone—Improvements in railways.
1129. William Edward Newton, 66, Chancery-lane—Improved machinery for removing snow from railroad tracks. (A communication.)

Dated 14*th May*, 1856.

1131. Henry Bragg, jun., Belfast—Improvements in machinery or apparatus for finishing linen and other fabrics.
1133. Hiram Groves, New York—Improvements in tune barrels or cylinders, or other apparatus for playing upon organs or other musical instruments.
1137. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved distance indicator for public carriages. (A communication.)
1141. Charles Henry Olivier, 37, Finsbury-square—Improvements in the mode of preparing and applying silk waste. (A communication.)
1143. William Crofts, Derby-terrace, Nottingham-park—Improvements in the manufacture of lace and other weavings.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 23*rd*, 1856.

2640. Thomas Tuckey.
2644. Joseph Ellisdon.
2652. Juliana Martin.
2655. Louis Joseph Frederic Margueritte.
2665. Robert Bell.
2670. Enoch Tayler.
2675. George Louis Stott.
2693. Thomas Symons.
2700. John Ramsbottom and John Charles Dickinson.
2760. Henry Hart.
2773. Charles François Jules Fonrobert.
2786. Peter Armand le Comte de Fontainemoreau.
2787. Josiah George Jennings.
2788. Josiah George Jennings.
2789. Josiah George Jennings.
2807. Isaac Beardsell.
2940. Henry George Baily.
53. Samuel Cunliffe Lister and William Tongue.
136. Joseph Schloss.
380. Walter McFarlane.
434. John Henry Johnson.
456. William Strang.
537. François Ruelem.
549. Thomas Lambert.
649. Peter Appleton.
691. James Bryant, jun.
707. John Dearman Dunnicliff and Stephen Bates.
761. John McLean.

Sealed May 27*th*, 1856.

2680. Thomas Warren.
2685. Benjamin Rosenberg.
2688. William Alfred Distin.
2698. George North.
2745. Arthur Paget.
2774. John Radcliffe and Thomas Vickers Favell.
2781. James Cocker.
2832. Thomas Warren.
2842. Samuel Fletcher Cottam.
2848. Omrod Coffeen Evans, M.D.
2909. James Chesterman.
15. Charles Toye.
19. James Regster Lyall.
90. Emile Constantin Fritz Setelet.
106. William Owen.
276. Charles Robert Moate.
313. James Howard.
355. Thomas Steven.
502. William Exall.
571. The Chevalier Guillaume Hebner.
696. John Jucken.

Patents on which the Third Year's Stamp Duty has been Pa

May 19*th*.

1259. Louis Gervais Dieudonné Buffet Delmas Ducayla.
1302. Julius Augustus Roth.
1316. Caleb Hill.

May 20*th*.

1258. William Chisholm.
1267. Auguste Edouard Loradoux Bellford.

May 22*nd*.

1271. Henry Turner.
1366. Isaiah Kendrick.

May 23*rd*.

1295. Alphonse René le Mire de Normandy.
1381. Benjamin Biram.

May 24*th*.

1313. Ebenezer Nash and Joseph Nash.
1360. Joseph Whitworth.

Journal of the Society of Arts.

FRIDAY, JUNE 6, 1856.

ANNUAL CONFERENCE AND DINNER.

The Annual Conference of the Representatives from Institutions in Union with the Society is appointed to be held at the Society's house, on Monday, the 23rd of June.

The Annual Dinner will take place at the Crystal Palace, on Tuesday, the 24th of June. The Right Honourable Lord Ashburton, F.R.S., will preside.

TWENTY-FIFTH ORDINARY MEETING.

Wednesday, June 4, 1856.

The Twenty-fifth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 4th inst., Joseph Glynn, Esq., F.R.S., in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Hogg, Alexander.
Tussaud, Francis Babington.

The paper read was—

THE MANUFACTURE OF BRICKS BY MACHINERY.

By Humphrey Chamberlain, Draining Engineer, Kempsey, near Worcester.

The manufacture of bricks is a subject embracing so great a diversity of treatment, from local circumstances, the varying chemical quality of the earths or clays, and the great number of improvements lately introduced, as well as from the multifarious processes under which the manufacture is carried on, that I am obliged to abandon describing the principle best suited to each particular class of earth, and merely to give a general idea of the manufacture and the mechanical contrivances invented for its improvement, nor will the limits of this paper allow of more.

The process of brickmaking is one of the most ancient manufactures in the world. We are told in Scripture that the tower of Babel was built with well-burnt bricks; that the walls of Babylon were of a similar construction; and that the Israelites, during their oppression by the Egyptians, were employed in brickmaking. The ancient Romans were brick and tile makers; excellent specimens of their manufacture still remain. In England, bricks were not generally used until the middle of the 15th century. The Lollard's Tower, Lambeth Palace, built in 1454, is about the most ancient brickwork in London. The old part of Hampton Court was built in 1514.

I have given this glance at the antiquity of the process to show that, although so ancient, it has received scarcely any improvement from the aid of machinery until within the last few years.

At the present time bricks are manufactured in the most primitive way. Those made by hand are generally of very inferior quality to machine-made ones. The numerous titles of the London bricks best illustrate the state of this manufacture. There are wash bricks, grey stocks, rough stocks, paviours, pickings, grizzles, place, shuffs, and numerous other titles. Now, there should be but one quality, if the process was carried out with good machinery in a suitable manufactory, and those all best bricks. A very few experiments will prove a clay, as to what preparation or mixture of other earths it requires, and the temperature at which it burns to the best colour and soundest article. From the London makers so strictly adhering to the old system of handmaking and clamp burning, they have opened a market for makers by machinery over the country, who, from the superiority of their ware, command such a price, that they can now afford to send bricks by railway, 80 and 100 miles, to the metropolis.

One great check to improvement, both here and at Manchester, is the existence of clubs amongst the men, but these must give way as other districts advance.

The importance of the brick trade is illustrated by the following:—

The quantity of bricks made per annum in this kingdom is about 1,800,000,000. Of this quantity Manchester alone makes about 130,000,000 per annum. What are termed the London makers produce about the same quantity, but bricks are sent to the metropolis from a circuit of 100 miles; it is, therefore, impossible to give exactly the consumption. Taking bricks at the low average of three tons per 1,000, the annual make exceeds in weight 5,400,000 tons, and the capital employed must be upwards of £2,000,000 sterling.

Before entering on the manufacture by machinery, I will briefly describe the present process of making by hand, as practised in the neighbourhood of London.

The clay is dug in the winter, and spread over a large surface of ground, to expose it as much as possible to weather, more particularly frost, to act on the compact tough mass, and so divide it into as small particles as possible, that during the summer, or making season, labour may be saved in working in that quantity of water which is necessary to bring it into a ductile mass. This clay is thrown out in layers, over which are spread coal ashes, or what is termed breeze, which perform several functions. First, they make the clay of a more porous and open character, which is attained by using sand in the country; secondly, they prevent the clay shrinking too much, and the sun and the wind cracking the bricks when drying; and thirdly, they are useful in the firing of the ware, by assisting to burn the bricks. Chalk is also added, for the sake of colour, and acts as a flux on the silica of the clay in burning. This is tempered by hand into an even mass of soft clay or mud, which is effected by turning it over several times with wooden spades, and at each turn working in as much water as possible. This operation is not considered complete until all the clay has absorbed an equal quantity of water, and become a thick plastic mud; to effect this pug-mills are also used, and chalk mills, but the latter is more for the sake of colour, and is only a local practice. This clay is made into bricks by an artisan called the moulder, who is supplied by an attendant lad with a lump of the material, rather more than sufficient to fill a small box, in shape a parallelopipedon, called a mould, containing about 150 cubic inches, in some parts of the country nearly 200 cubic inches, varying a little in size in most districts. The art of the brickmaker, or moulder, is the knack with which he throws, or drops, this soft clay into the mould, so as to fill up every corner. This is apparently a very simple process, and is the one to which I shall have to draw your attention this evening, and the accomplishing of which by machinery has caused a vast expenditure of time and money, and occupied the attention of many leading mechanics for some years. These moulds are emptied by being turned over on a board called a pallet board. The material used being soft clay, and the mould kept constantly wet by dipping in water between each charge (which is called slop-moulding), or sprinkled with sand or dust, the brick easily drops from the mould on its being held over the pallet board. The bricks, when moulded, are carried or wheeled away to the hacks, or drying floors, where they are placed edgeways, about half an inch apart, or the thickness of the pallet board, one row on another until they form a wall 6 or 8 bricks high; they are then covered up and left to dry, ready for the burning. This latter process we shall discuss in a succeeding paper.

The number of patents taken out, connected with the manufacture of bricks, has been obligingly supplied to me by Mr. Carpmael; they exceed 230. It would be impossible to describe each particular machine, and I, therefore, propose to illustrate, as clearly as I can, the several principles which have been attempted by these inventors, and with what success. I shall not occupy you by references to the earliest inventions, as we know they were not successful, or they would be worked at the present day; but will notice those principles now before the public.

Before commencing with the manufacture of the brick, we must prepare the raw material—clay.

There are few places on almost the whole of the geological strata of this country, which do not possess alumina in combination with silica and other earthy matters forming a clay from which bricks can be manufactured. That most generally worked is found on or near the surface in a plastic state. Others are hard marls on the coal measures, new red sandstone and blue lias formations. It is from these marls that the blue bricks of Staffordshire and the fire bricks of Stourbridge are made. Marl has a greater resemblance to stone and rock, and varies much in colour; blue, red, yellow, &c. From the greatly different and varying character of the raw material, there is an equal difference in the principle of preparation for making it into brick; while one merely requires to be turned over by hand, and to have sufficient water worked in to make it subservient to manual labour, the fire-clays and marls must be ground down to dust, and worked by powerful machinery before they can be brought into even a plastic state. Now these various clays also shrink in drying and burning from 1 to 15 per cent., or more. This contraction varies in proportion to the excess of alumina over silica, but by adding sand, loam or chalk, or (as is done by the London brick-makers), by using ashes or breeze, this can be corrected.* All clays burning red contain oxides of iron, and those having from 8 to 10 per cent. burn of a blue, or almost black colour. These bricks are exposed in the kilns to great heat, and when the body is a fire-clay, the iron melting at a lower temperature than is sufficient to destroy the bricks, gives the outer surface of them a complete metallic coating. These bricks are common in Staffordshire, and when made with good machinery, (that is, the clay being very finely ground) are superior to any in the kingdom, particularly for docks, canal or river locks, railway-bridges, and viaducts. Other clays contain lime and no iron; these burn white, and take less heat than any other to burn hard enough for the use of the builder, the lime acting as a flux on the silica. Many clays contain iron and lime, but where the lime is in excess, the bricks are of a light dun colour, or white, in proportion to the quantity of that earth present; if magnesia, they have a brown colour. When iron is in excess, they burn from a pale red to the colour of cast-iron, in proportion to the quantity of metal, as I before explained.

There are three classes of brick earths:—

1st. Plastic clay, composed of alumina and silica, in different proportions, and containing a small per centage of other salts, as of iron, lime, soda and magnesia.

2nd. Loams, or sandy clays.

3rd. Marls, of which there are also three kinds; clayey, sandy, and calcareous, according to the proportions of the earths of which they are composed, viz., alumina, silica, and lime.

Alumina is the oxide of the metal aluminium, and it is this substance which gives tenacity or plasticity to the clay, having a strong affinity for water. It is owing to excess of alumina that many clays contract too much in drying, and often crack on exposure to wind or sun. By the addition of sand this clay would make a better article than we often see produced from it. Clays contain magnesia and other earthy matters, but these vary with the stratum or rock from which they are composed. It would be impossible to give the composition of these earths correctly, for none are exactly similar; but the following will give an idea of the proportions of the ingredients of a good brick earth; silica three-fifths, alumina one-fifth, iron, lime, magnesia, manganese, soda and potash forming the other one-fifth.

The clay, when first raised from the mine or bed, is, in very rare instances, in a state to allow of its being at once tempered and moulded. The material from which fire-bricks are manufactured, has the appearance of ironstone and blue lias limestone, and some of it is remarkably hard, so that in this and many other instances which I shall have to notice, in order to manufacture a good article, it is necessary to grind this material down into as fine particles as possible.

Large quantities of bricks are made from the surface marls of the new red sandstone and blue lias formations. These also require thorough grinding, but from their softer nature it can be effected by less powerful machinery.

The principal machines which have been worked for this purpose are three—1st. The pug mill. 2nd. The wash mill. 3rd. The rolling mill.

The pug mill is a cylinder, sometimes conical, generally worked in a vertical position, with the large end up. Down the centre of this is a strong revolving vertical shaft, on which are hung horizontal knives, inclined at such an angle as to form portions of a screw, that is, the knives follow each other at an angle forming a series of coils round this shaft. The bottom knives are larger, and vary in form, to throw off the clay, in some mills vertically, in others horizontally. Some have on the bottom of the shaft one coil of a screw, which throws the clay off more powerfully where it is wished to give pressure.

The action of this mill is to cut the clay with the knives during their revolution, and so work and mix it that on its escape it may be one homogeneous mass, without any lumps of hard untempered clay; the clay being thoroughly amalgamated, and in the toughest state in which it can be got by tempering. This mill is an excellent contrivance for the purpose of working the clay, in combination with the rollers, which I shall describe presently; but if only one mill is worked, I should not adopt it generally, for, although it tempers, mixes, and toughens, it does not extract stones, crush up hard substances, or free it from all matter injurious to the quality of the ware when ready for market. This mill can be worked by either steam, water, or horse-power; but it takes much power in proportion to the quantity of work which it performs. If a brick is made with clay that has passed the pug mill, and contains stones, or marls not acted on by weather, or lime-shells (a material very common in clays), or any other extraneous matter injurious to the brick, it is apparent from the action of this mill that it is not removed or reduced. The result is this, the bricks being when moulded in a very soft state of tempered material, or mud, considerably contract in drying, but the stones or hard substances not contracting cause the clay to crack; and even if they should not be sufficiently large to do this in drying, during the firing of the bricks there is a still furthur contraction of the clay, and an expansion of the stone from the heat to which it is subjected, and the result is generally a faulty or broken brick, and on being drawn from the kilns the bricks are found to be of inferior quality, commonly termed addled—that is, having no ring or metallic sound when struck—liable to great waste from breakage in carriage and otherwise deteriorating the ware. In the case of lime, on exposure to the atmosphere these shells, from absorbing moisture, lax or swell, forming lime powder, and in so doing burst the brick to pieces.

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* Note.—Before commencing to work a bed of clay, in the first place it is necessary to ascertain its contraction in drying and burning. Secondly, how this can be corrected at the least expense if in excess. The necessary proportion of sand, lime, or chalk, would so vary with the clays, that no rule could be laid down, and it must be left to actual trial.

Next is the wash mill; but this I must merely glance at, as it cannot be practically worked for the manufacture of common bricks on a large scale, but only for front bricks. By a general adoption of good brick machinery, and a more general knowledge of the preparations of clays, we should have all our bricks equal in quality to what are now termed front bricks. This mill is a large circular trough, round which is a horse walk. The clay is worked in this trough with water by harrows drawn by one or two horses, until it is all thoroughly mixed up into a fluid state. It is then let off into a pit at a lower level through a grating or a series of gratings, which extract all stones and coarse undivided particles. In proportion to the fineness of these gratings or sieves, so is the quality of the clay. It is there left to subside, the water is then let off from the top, and the clay, when sufficiently stiff, is thrown out for work. By this means clay can be prepared of the finest quality. This is the principle on which china and earthenware clays are prepared after grinding. The expense would prevent its becoming general with brick-makers; and in the case of fire clays, marls, or any such earths as produce our best materials, it would be useless until they were ground down. It also consumes a large quantity of water, which could not be had in sufficient abundance in many districts.

I now come to the rolling mill, which is by far the most practical of all, and its general adoption throughout the kingdom would do more to improve the quality of our bricks than any other process. It consists of a pair or pairs of horizontal cylinders running near together, between which the clay is crushed. When bricks are made by hand, or a machine is used which does not pug the clay, I recommend the use of the pug mill, combined with the rolling mill. The clay passing first through the rollers and then through the pug mill, is ready for use.

All practical men must agree that you cannot have the clay in particles too finely divided, and this very fine division cannot be effected by that universally used pug mill. The first process is to crush or grind your material, and then to pug or work it. These mills are—in the case of fire clays, or any very hard rough substance, such as marls—series of pairs of rollers (generally three pairs) driven by steam. The clay is thrown into the top pair, which are set rather wide apart; the next pair are nearer together, and run at a greater speed, and the third, or bottom pair, are nearly close, and run sufficiently fast to take all the clay as the top pair throw it down. The clay enters these rollers a hard rocky material, and escapes from them entirely ground to a fine dust. For general works, a good single pair of rollers is sufficient. If a marl or hard substance is to be ground, the rollers must be larger in diameter than for unctuous clays, that their larger circumference may bite the marl and draw it in. If the diameter is too small, the lumps would ride between the rollers, and not be crushed without some trouble. For general brickworks a pair of rollers, 3 feet in length, and from 2 feet to 3 feet in diameter, will be found sufficient. The quantity of clay which can be prepared by these mills will be four times as much as can be done by the pug mill with the same power, and much better, as no portion of it can escape being crushed and minutely divided. These rollers are too often geared to run each at the same surface speed, but I have found that by running the one roller three times as fast as the others, (that is, gearing the wheels which connect the rollers at 3 to 1) a double action is obtained, not only crushing the clay and all hard substances into the finest particles, but also a rubbing action, which more thoroughly divides and amalgamates it, giving also more power to crush up a hard substance than by the pinch of equal rollers. The nature of clays varies so greatly, that no fixed rule can be laid down for their preparation, or whether a combination of rolling mills and pug mills are necessary, yet this process is most essential if a good article is required. In some works it is necessary to pass the clay through four pairs of rollers and two or three pug mills, while in another, at no considerable distance, from the difference of the clay, as fine a state of the material may be produced by passing it through a single pair of rollers. I dwell on this subject, as it so materially affects the action of machines and the quality of the ware when made; in fact, this is the groundwork of brickmaking, as it is of all pottery, from china downwards. If we look at pottery, the beautiful stone ware now produced, the large glazed socket pipes used in our town drainage, &c., these are made by machines, but the quality depends more on the preparation of the clay, or the fineness to which it is ground or crushed, than on the machine which moulds it. In most cases a good brick machine should take the clay after it has been crushed through rollers, and thoroughly amalgamate, or pug and work it, during its manufacture into bricks. Some clays require for a good brick machine little or no preparation, but these are rare, and they are fortunate who possess them. I have, therefore, only treated of those clays which are most difficult and expensive to work.

There is a system of preparation called screening; but this only answers for tilemaking, and that on a very small scale. A pair of rollers would do more, at less expense, and better.

If the London brickmakers would use rollers, and crush their clay and ashes altogether, so fine that no hard substance could be felt with the hand, their bricks would be of a very superior quality to what they now are.

There are other systems of preparation; but I have treated of those most universally adopted.

The next process is the manufacture of this clay into bricks; and I cannot refrain here from mentioning what an injurious effect the present system of hand-making has on the habits of the men. The brickmakers (that is, the moulders and their attendants), men and lads, are, throughout the kingdom, employed at their trade only during six or seven months in the year, except where bricks are artificially dried, in the neighbourhood of collieries. In the winter season, the bricks would be destroyed by frost; neither could they then be dried. They therefore work early and late; and from their having no winter occupation, and on account of their dirty and laborious work, they have such a price per thousand as to compensate them. The result is generally, among this class of men, that, although they are so well off in the summer time, they spend all they earn, leaving the winter to provide for itself. At that season, when they require most to sustain both themselves and their families, as well as fuel, they have nothing to fall back upon, and in too many instances no employment; for, as they earn so good wages in the summer, they do not willingly come down to the price of ordinary labour. These are the men whom the introduction of machinery will affect.

Before entering on the manufacture by machinery, I should state that brickmaking was carried on till within the last few years with comparatively few attempts at improvement. Until the duty was taken off, in 1850, the regulations of the Excise were so strict that any attempts at progress were frustrated; but, since the above date, most rapid strides have taken place. Machinery has been constructed on all seemingly possible principles to produce this ware in greater quantity, and of superior quality; so that, as far as mechanical make is concerned, it may be called a new manufacture. Although machinery had been worked for many years, it attracted little attention, from its frequent failures in practice. For this reason, new plans have been introduced for the forming of clay into bricks. I shall therefore feel it my duty, in describing these machines, to point out those parts of the several principles adopted which have prevented their being more generally used.

Brick machines are now very cautiously watched by the makers, which is a matter of no astonishment; for so many machines have been brought out without a due consideration in their construction of what is required by the brickmaker, and many have been introduced by mechanics not at all conversant with brickmaking generally. When they had succeeded in forming a block of earth of the required size, they thought they had attained all that was necessary. I would recommend all, before purchasing, to see a machine in regular every-day work, and to minutely examine the ware which is being sent out for use, the production of the machine.

In a former part of this paper I have mentioned that we wish to manufacture by means of machinery a rectangular block of clay about 10 inches long, 4¾ inches wide, and 3¼ inches deep, containing some 154 cubic inches, into as compact, hard, and durable a material as a block of stone.

There are four principles on which these machines effect this, one of each I shall briefly describe. 1st. By moulding the dry clay (that is, clay containing only sufficient moisture to allow its particles to adhere, when subjected to considerable pressure) by powerful machinery; 2nd. by imitating the old process of hand-making, filling moulds with soft-tempered clay like mud; 3rd. by forcing clay in a stiff plastic state through dies or apertures the size of a brick, endways or edgeways (a die is a plate with a hole cut in it of the shape which is desired to be given to the clay); and, lastly, forming a stream of clay to the desired shape by rollers.

I will, before explaining these in detail, describe the general principles on which clay is forced into or through these dies and moulds.

The oldest plan of working clay down, and pressing it off through any given aperture, is the pug mill, which I have before described in the preparation of the clay. This mill is used by both classes of inventors to fill moulds traversing under its delivery, to express the clay through dies, or to fill the material into boxes in which work plungers or pistons to force the clay out through a die as soon as it has received its charge. Next, we have pistons worked by all sorts of mechanical contrivances, of wheel-work and racks, cranks, eccentrics, screws, &c., forcing the clay from boxes or cylinders in which they traverse backwards and forwards, and so by their downward passage force the clay through any given aperture or die. These machines lose much time, as during the up or return passage of the piston all brick-making is at a stand. Another expressing machine, the patented invention of Mr. Ainslie, is a pair of rollers or horizontal cylinders, driven at a like surface speed, having one side closed, in front of which is the die. The rollers being driven, draw the fed clay through between them, and force it out in one continuous stream of the desired shape.

The next, and, as I have found in my experiments, the most powerful, is a screw fixed on a shaft hung through the centre of a cylinder. The screw in revolving carries the clay down its thread, and not only forces it on with immense power, but so works the clay in its onward passage as to be equal to the pug mill when used in combination with a rolling mill. The clay naturally adheres to the stationary surface of the cylinder, and the screw by its revolutions keeps it in a constant state of motion, and rolls and works it, and when it arrives at the end it is forced on through any required orifice. An example of this is before you in the pug mill part of my machine, but with the addition of knives on the thread of the screw.

To explain the whole of the mechanical contrivances invented for forcing and expressing clay, either through orifices or into moulds, would not aid us in the practical manufacture of bricks, and would, without drawings, occupy too much of your valuable time.*

The first plan adopted which I propose to discuss is that of moulding dry clay, or clay as dug from the earth. This has been worked on several principles. The dry clay American machine is about the best example of this class. The clay is merely dug from the earth, and ground through rollers from which it falls into the hopper of the machine. The bottom of this hopper is a cast-plate in which are 14 brick-moulds. This mould plate is rather more than double the length of the hopper, and travels backwards and forwards, being driven by wheel-work; so that while one-half of the plate, containing seven moulds, is being filled under the hopper, the other seven are being emptied outside. The moulds have moveable bottom plates or pistons, which are forced up by an inclined plane as soon as they are free from the hopper, and throw out the bricks contained in them. The moulds are filled as they traverse backwards and forwards by having to pass under a wheel which presses the clay into them. This wheel is hollow, and is filled with steam to heat it, so that the clay may not adhere. I have known an instance on a railway, where the bricks, made of blue lias clay by this machine, were so smooth on the mortar surface, that bridges had to be taken down and re-built, because the mortar would not adhere to them. Others force the clay down cylinders into moulds by means of a screw, and some by hydraulic pressure produce a brick ready for the kilns. But these machines are not likely to come into general use, for they have to exert so great a force in order to press the comparatively dry material into the moulds so as to fill all corners (here is the difficulty and the consumption of power), and at the same time so to compress the clay, as to make it sufficiently firm, not only to adhere, but also to withstand the weight of 30 or 40 deep, one row on another, in the kilns. There must necessarily be an immense amount of power consumed for the purpose of obtaining what is considered a more solid and durable brick. But this is an error which I shall shortly explain. This class of machinery is very expensive. The American, with the engine, costs upwards of £1,400. These machines average the consumption of 20 horse power to drive them. A breakage with this large machinery is very serious, and of too frequent occurrence. I shall be met by the promoters of these machines with the advantage of working up dry clay, saving the whole process of drying the bricks, the labour of carrying to the drying ground, and again removing to the kilns, also with being able to work all the year uninterruptedly, and independently of seasons. But with how few clays can this be accomplished? The clay is not really dry; it has sufficient moisture to allow it to adhere and give it toughness to support the weight of the stack in the kilns. The great pressure to which it has been subjected in the machine makes it so compact a mass, that it would take a long time thoroughly to dry it. The result would be, in plastic clays, if this principle were generally adopted, that when the firing of the ware was commenced, the outer surface would be dried, but from its close texture the moisture in the centre could not evaporate. The greater heat, as the process of firing proceeds, makes the brick hot, and the moisture in the centre, forming steam, would in most cases blow it to pieces. In many clays the outer surface will shell off, but in others of a more open character, that is, of a more loamy kind, it would be only partially rent, and this would generally cause the bricks to be less solid and compact than those made from tempered plastic clay, which in drying has become sufficiently porous to allow this steam to escape. The firing of the ware made on this principle is as great a drawback as the expensive machinery necessary. The clay being so powerfully compressed into the moulds, is held on every surface by adhesion. When the pressure is taken from the top, and the piston or bottom of the mould begins to rise, the outer surface of the brick adheres so tightly to the inner surface of the mould, that it takes great power to move it. The centre of the brick, in some clays, rises a little the first, and causes one mortar surface to become slightly concave. The outer edges drag, from the great friction they have to encounter in being freed from contact with 90 inches, or a square surface of more than half as many superficial inches as there are solid inches in the brick itself. These machines are better adapted for marly than plastic clays.

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* I recommend a continuous delivery, with a good preparation of the clay; and that on the principle absorbing least power.

I will now take the working of clay in a soft state, or of the same temper as for hand-making.

The machines for this purpose have all necessarily adopted the principle of moulding, which is much more easily performed than with dry clay, as not more than about four-horse power is required. We have the same duty to perform as with dry clay, viz., to fill each corner* of the mould and to expel all the air. A machine of this class was introduced some few years since by Messrs. Ransome, of Ipswich, from America. (Hall's machine.) This was a pug-mill, which forced the clay into a series of six moulds. A man in attendance, by wheel-work, gave the clay a pressure into the moulds with one leverage, and with another drew out from under the machine the six full moulds, the same action replacing them with six empty ones. Although largely used in America, it did not become general here. The difficulty in this class of machinery is, that while the moulds are being drawn from under the pressure of the clay, directly one part of the mould is clear, the pressure, which is on that part of the brick still under the machine, lifts or forces the clay upon that side or end which is free from pressure; and when delivered, the bricks are of unequal thickness.

One machine, the London Company's Brick Machine, corrects this by striking or cutting off this superfluous clay after it has left the mill or pressure.

Machines working soft clay have several disadvantages for the brick-field; the material being in such an almost fluid state, the bricks are very subject to be injured in form in being carried off. Nor are these machines sufficiently portable to be easily moved each day as the drying ground is filled round them. The clay being worked in so soft a state, the great evaporation in drying leaves the bricks very porous, if it is a loamy clay, or causes them to undergo an excessive contraction if a strong one. Neither are they sufficiently stiff to be delivered from the mould by the machine, but would have to be taken off by hand and emptied, which is a very slow process and incurs considerable manual labour, as the machine requires not only to have the moulds taken from it and emptied, but also to be fed with them again. In brick-making by machinery, we should employ as little labour as possible, but should give the machine the raw material and take away the manufactured article without any intermediate labour. It is, in my opinion, a serious objection to have to feed a machine with moulds, as is generally done in this class of machinery. In making 15,000 bricks a day, and calculating the moulds to weigh 4lbs. each, which is a low average, as they are generally made of metal, we have to employ the extra manual labour of taking off, and again feeding on the machine (two removals) rather more than 53½ tons of iron, or of whatever the material the moulds may be composed; while the whole weight of clay for the day's work is not more than 75 tons. Unless the machines can be easily moved from day to day as the drying ground is filled, great additional labour will be incurred; for the softness of the clay will not allow the bricks to be roughly wheeled, and they must be transported very carefully.*

I now come to brickmaking by machinery with clay in a plastic state, but of such a stiffness that the bricks, when made, are too firm to lose their form in carriage or removal from the machine to the drying ground, or in that state of temper in which it will make, in most clays, the best and soundest article, if properly mixed and prepared, having only sufficient moisture to allow of its being thoroughly amalgamated. This clay will make bricks which, when well burned, will have a very metallic sound on being struck; and this is the best proof of their solidity and close texture.* Bricks are made with clay in this state by moulding; by pressing through dies; by forcing through dies with tongues or cores (making hollow or perforated bricks); and, lastly, on the principle of my own machine, by taking the stream of clay from any expressing machinery, and forming it into a block by rotating surfaces. Moulding is subject to the same difficulties which I have described in soft clay—the lifting in the end or side of the mould first relieved from pressure, though not to the same extent. But it takes considerably more power to drive the machines, and to fill the clay into the bottom corners of the moulds. In these machines the bricks are delivered from the moulds by pistons, as in dry clay, but are more subject to swell on the upper mortar surface, and to drag on the sides of the moulds.

There are many principles on which the moulding of the clay is worked; but the limits of this paper will not allow of my explaining them. The system of forcing the clay through dies the size of a brick, edgeways, and then dividing the stream of clay into bricks by a frame of wire three inches, or the desired thickness of the brick apart, has been tried by several; but here arises another difficulty—viz., to get a good smooth square corner or edge to the stream of clay as it escapes from the die. The large aperture through which it is forced, fifty square inches, does not offer a sufficient resistance to force the clay into the angles of the die. Clay, when expressed through an aperture such as this, travels fastest in the centre, having less friction or resistance through its own substance than over the smoothest metal, wood, or any fixed matter. Clays travel, when forced, in the same manner as water running through the same space. The centre of the stream, having the least friction, travels fastest; while the outside, from the friction of the stationary surface which it has to travel over, does not flow so fast. So it is with clay; that which escapes through the centre, meeting with no resistance, travels as fast as the power forces it forward; but the outward surfaces are constantly dragging against the stationary metal or wood of the die, and more particularly so at the corners, the clay escaping with jagged or saw-like edges. The corners of the square die have the smallest body of clay to contend with the largest amount of friction. To remedy this, Mr. Heritage brought out his patent water die, which is a double die, or escaping aperture, with the intervening space filled with water. The clay, after leaving the actual die with a rough edge, passes through the water, and then through the second smaller die, which greatly improves it. Another machine, Mr. Clayton's, was introduced to obviate the difficulty of a rough edge, by having the two ends of the die to rotate. This was an improvement in the right direction. When the clay is delivered from machines on this principle it has yet to be divided into bricks. The stream of clay is, in most instances, in constant motion, and in order to make 15,000 bricks per day, must travel seven feet per minute. The machines hitherto introduced cut off these bricks while in motion at right angles to the die, but having no compensating motion for the onward movement, they depend entirely on the speed with which the man can pass the frame of wires through the stream of clay. It is, therefore, impossible for them to make a square cut, and if at all nearly correct, they must work so slowly that the advantage of the machine is lost. A brick machine, to be perfect, should effect this, and not depend on manual labour. If the clay is travelling at the rate of 5,000 bricks per day, a man cannot cut them off square, while in motion, with a cutting apparatus working at right angles to the die. If there is a compensating motion on the wire frame, we have still equal difficulties to contend with; either the stream of clay escaping from the die does not travel at one uniform speed from irregular feeding, or the man in attendance draws his wires too slowly or too quickly to cut correctly. We have an example of this cutting in the Ainslie Co.'s tile machine, and a brick machine was exhibited at the Royal Agricultural Society's meeting at Carlisle last year on this principle, by Messrs. Porter, Hind, and Porter. The machine itself must do this with mechanical truth.

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* PATENT BRICK MACHINE COMPANY.—Since writing the above, I find the Patent Brick Machine Company have improved their machines; and, according to a circular I received this morning from the Secretary, Mr. Mount, they now work the clay in a much drier state than it can be moulded by hand. It should not, therefore, come under that class of machines in which I have placed it. It is also portable.—H. C.

* There are exceptions, but this is generally the case.

The most universally used die machine which has been extensively worked up to the present time is Mr. Beart's patent for perforated bricks. This gentleman, who is practically acquainted with these matters, in order to remedy the difficulties I have mentioned in expressing a mass of clay through a large aperture or die, hung a series of small tongues or cores so as to form hollow or perforated bricks. By this means the clay was forced in its passage through the die into the corners, having the greater amount of friction now in the centre. Still, the bricks came out rough at the edge with many clays, or with what is termed a jagged edge. The water die was afterwards applied to this machine, and the perforated bricks, now so commonly used in London, are the result. In Mr. Beart's machine, which is a pug mill, the clay is taken after passing through the rolling mill, and being fed in at the top, is worked down by the knives. At the bottom are two horizontal clay-boxes, in which a plunger works backwards and forwards. As soon as it has reached the extremity of its stroke, or forced the clay of one box through the die, the other box receiving during this time its charge of clay from the pug mill, the plunger returns and empties this box of clay through a die on the opposite side of the machine. The result is, that while a stream of clay is being forced out on one side of the machine the clay on the opposite side is stationary, and can, therefore, be divided into a series of five or six bricks with the greatest correctness by hand. Some of these machines have both boxes on one side and the plungers worked by cranks. This machine cannot make bricks unless the clay has previously passed through rollers, if coarse, for anything at all rough, as stone or other hard substance, would hang in the tongues of the die. But the clay being afterwards pugged in the machine, is so thoroughly tempered and mixed, that the bricks when made cannot be otherwise than good, provided they are sufficiently fired. As to the utility of hollow or perforated bricks, that is a matter more for the consideration of the architect or builder than for the brick-maker. Perforated bricks are a fifth less in weight than solid ones, which is a matter of some importance in transit; but it takes considerably more power to force the clay through those dies than for solid brick-making. In the manufacture of perforated bricks there is also a royalty or patent right to be paid to Mr. Beart.

Having thus explained the principles on which mechanics have attempted the manufacture of bricks, and not considering any of them quite perfect, I turned my attention to what was the cause of failure in these several principles.

In the moulding of clays in a dry state by machinery we have to employ great power and large expensive machines to force the clay into the corners of the moulds, and to sufficiently press it, so as to make it adhere. When we do succeed in making from the clay a nice true block, in appearance all we could wish, it has then to go through the ordeal of firing, from which with but few clays it would come out sound. Nor must we forget the serious and too frequent losses by breakage of these machines.

Next in moulding clays in a medium or stiff plastic state, and also in a soft plastic state, when the mould escapes from the pressure of the clay, that part which first leaves the machine is apt to be forced up above the mould, causing that end or side to be thicker, and in those which lift the brick out of the mould by pistons, from the clay dragging, that is, adhering so tenaciously to the inner surface of the moulds, an effect is produced of making one mortar surface concave. There is also a great wear on the moulds, from the pistons which lift the brick travelling in the grit of the clay; this soon cuts them larger, and the pistons must require frequent renewal.

Those machines which force the clay through dies to make solid bricks, should deliver it the length and depth of a brick edgeways, so as to cut every 3¼ inches, that the rough surface left by the wire may be the flat of the brick which forms the mortar joint. We have traced the difficulties of the dies, and also the imperfections of the cutting arrangements generally used. I came to the conclusion that for a brick machine to become generally useful, it should embrace the following advantages, and these I have attempted to realise. First, it should be portable, in order to save labour in carrying off. It should amalgamate or pug the clay, and then form it into a stream of material the size of a brick edgeways, and divide it into bricks by the action of the machine itself. It should have no cessation, but be intermittent in its action; it should work at great speed, that is, deliver off its bricks as fast as it is possible to remove them. To produce 15,000 per day we have to pass 75 tons of clay through the machine, and to make solid and hollow, or perforated bricks, with equal facility; in fact, I do not consider any machine perfect which requires assistance in cutting off or otherwise. As I before remarked, a machine should be fed with the raw material, and deliver out, without any assistance, the manufactured article, with the consumption of as little power as possible.

I shall now explain the action of my own machine, an example of which is before you.

The clay is fed into a pug mill, placed horizontally, which works and amalgamates it, and then forces it off through a mouth-piece or die of about 65 square inches, or about half-an-inch deeper and half-an-inch longer than is required for the brick, of a form similar to a brick on edge, but with corners well rounded off, each corner forming a quarter of a 3-inch circle, for clay will pass smoothly through an aperture thus formed, but not through a keen angle. After the clay has escaped from the mill it is seized by four rollers, covered with a porous fabric (moleskin) driven at a like surface speed from connection with the pug-mill.* These rollers are two horizontal and two vertical ones, having a space of 45 inches between them; they take this larger stream of rough clay, and press or roll it into a squared block of the exact size and shape of a brick edgeways, with beautiful sharp edges, for the clay has no friction, being drawn through by the rollers instead of forcing itself through, and is delivered in one unbroken stream. The rollers in this machine, perform the functions of the die in one class of machinery, and of the mould in the other. They are, in fact, a die with rotating surfaces.† By hanging a series of mandrills or cores between these rollers, or by merely changing the mouth-piece, we make hollow and perforated bricks, without any alteration in the machine. The pulley which drives the belt working these rollers, is not of sufficient diameter to be able to draw the clay away from the mouth-piece, if the man feeding the machine should neglect his work. This small pulley runs loose in its strap, leaving all the details of the machine stationary until more clay is fed into the mill, when it again immediately resumes its functions. The bottom roller carries an endless belt, on which the stream of clay is delivered to the cutting-frame. This carries a wire, which is constantly traversing at a compensating angle, while the clay is in motion, and thereby makes a square cut. After it has divided one brick, it changes its action and cuts off the succeeding one at the opposite angle to that which it had previously traversed. This wire is put in motion from gearing in connection with the rollers, which press the block of clay into the shape of a brick, and thereby acts with mechanical correctness. For if the smallest portion of clay escapes from the mill, motion must be given to the rollers, or rotating die by the driving strap, and from them to the cutting wire. The bricks, as fast as made, are passed on by the machine to boys in attendance, who receive them on pallet boards, and remove them to the drying floors or hacks. It will be seen that I form my brick or squared block of clay with less power and friction than by moulds or dies, that no resistance is offered to the clay, but that, on the contrary, it is impelled forward by the driven rollers; that from the machine itself cutting off the bricks at an angle, compensating for the onward movement off the clay, not only a true cut is made, but also the intermediate labour required by most other machines is saved. This machine, with four-horse power, will throw of bricks, if fed with clay, faster than it is possible to remove them. Another advantage in the pug-mill is that the clay is thoroughly amalgamated. Bricks can be made by this machine for one half the cost of hand-making. If it was employed for thirteen weeks, making only 15,000 a day, the saving of labour would purchase the machine; and each machine occupied throughout the year would effect a saving of £600 per annum. Besides this, the superiority of the bricks made by it commands a higher price in the market. Four hundred of these machines occupied throughout the year would make all the bricks required for the use of this country, and effect a saving of £240,000 a year in labour.

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* The feeding these rollers with a stream of clay by means of the die falls within the claims of a Patent taken out by Mr. Clayton. I have, therefore, made arrangements with that gentleman for the use of that part.

† The original inventor of using rollers to compress the clay into any desired shape was the Marquis of Tweedale.

I trust you will not think me egotistical in thus dwelling on my own invention; but it is the result of many years' careful thought, and many very expensive experiments. As it is a subject with which I have been closely allied for the last fifteen years, I flatter myself that I have introduced a machine that is adapted to the requirements of the practical brickmaker. I should mention that brick-machines generally are large fixed machinery, of great weight. I allude to this that you may not form an erroneous idea from the small affair now before you. I exhibited this machine for the first time on the 6th of September last, at the Liverpool and Manchester Agricultural Society's Show, at St. Helen's, when I was awarded a silver medal. I was there timed as to my make, and with 25lbs. pressure on one of Clayton and Shuttleworth's 6-horse-power portable steam-engine, at 45lbs. per inch, I made 35 bricks per minute. I next exhibited it at Coleshill, to the Warwickshire Agricultural Society, and was awarded a prize; next at Leek, at the meeting of the Staffordshire Agricultural Society, when I was again awarded a silver medal and a prize. I have since shewn the machine at Worcester, where it was awarded a fourth prize. I have never publicly exhibited it at work without receiving a prize or a silver medal. I shall show it at work during the show of the Royal Agricultural Society at Chelmsford next month. All this is apparently of little moment to a meeting like the present, but it is a matter I feel bound to mention, as I know of no other brick-machine which has received such distinction in this country, and I have no doubt it was the cause of my having had the honour of receiving the invitation of this Society to read a paper on the subject. I must also plead for your indulgence for having so long dwelt upon my own invention.

I much regret that, from being occupied in business, I have not been able to devote that time to the preparation of this paper which I could have wished, but if it is the means of opening a discussion among gentlemen present, I shall have attained the object aimed at by this Society, and from it I hope to derive further knowledge on a subject in which I take great interest.

DISCUSSION.

Mr. Robert Rawlinson, C.E., (in a note to the Secretary,) said he had paid much attention to the manufacture of bricks by machinery, having used them on a large scale in the great ceiling at St. George's Hall, Liverpool. These bricks were made by Mr. Scraggs, of Tarporley, in Cheshire, in a common land-drain tile-machine. The idea was taken from a land-drain. The bricks were twelve inches long by four inches square, with a longitudinal perforation of two inches diameter. In fact, a two-inch field-tile, made four inches square instead of being round. All the bricks were set "headers" in the arch; and this arch, which was seventy feet span, was only one brick in depth, or twelve inches, being the largest span and the lightest arch in the world. Machines could make bricks of any sectional form; and moulded bricks, or rather, bricks to form mouldings, might be made as easily as plain bricks. At present there were not makers sufficient to supply the demand. He had specified, several times within the last five years, for machine-made bricks, but had had to resort to hand-made ones, either because there was no offer, or a most extravagant one for machine-made bricks. In the year 1849, he (Mr. Rawlinson), in his report to the General Board of Health, on an enquiry into the sewerage, &c., of Birmingham, entered very fully into the question of the manufacture of bricks, and the comparative efficiency and cost of hand-made and machine-made bricks, and of hollow tiles and solid bricks.

Mr. Beart (of Godmanchester, Huntingdonshire) said that but for the observations of Mr. May, and being called upon by the chairman, he had not intended, nor was he prepared, to say anything upon the subject before the meeting. Mr. May alluded to his services having conferred a great boon upon the agricultural interest in being the first to introduce machinery for making tiles, and causing a reduction in their cost for land-draining purposes. Mr. Beart stated that in 1832 he took out a patent for a machine for making tiles, and the result was, that tiles, which had previously been selling at 36s. per thousand, were at once reduced to 20s.; and in the neighbourhood of his works, in Huntingdonshire, they were now selling at a still lower rate. The effect, also, in other parts of the kingdom had been to reduce cost. The year 1842 might be taken as the period from which the greatest improvements and advance had been made in adapting machinery to supersede the making of bricks by hand labour. In that year machines were introduced for expressing clay by pistons and other means through dies, having orifices for making bricks either solid or perforated, also pipes and tiles for land drainage. It was not his intention, without consideration, to discuss the subject of brick machinery, further than to say such machinery stood in a different position to machinery in general. A machine that would spin cotton in Manchester would do the same in any other place, but this was not the case with brick machinery, which must be adapted to the peculiar clay it had to work. Clay varying in different localities, required different arrangements of machinery for its working; and upon some clays, or mixed substances of which bricks were made, no machinery had up to the present time been brought to bear. In the conclusions arrived at by Mr. Chamberlain, there were one or two points in which he begged to differ. That gentleman stated that solid bricks, when made very dense, of plastic or adhesive clays, would, on burning, break or fracture, from steam generated by heat in the interior of the brick not being able to escape. This was not philosophically correct. Clay being a substance which contracted both in drying and burning, if the surface was dried too rapidly, and before the moisture escaped from within, the outside would contract before the inside; consequently, fractures would in such clays take place, and great breakage in the drying and also burning, so that, commercially, the waste in manufacturing was too great to enable the brickmakers to produce bricks at a marketable price. In perforated bricks this difficulty was in a great degree overcome, as the perforations reduced the quantity of clay, enlarged the surface for the evaporation of moisture in drying, and admitted the fire in burning. Bricks made in this manner could not only be produced at a lower price than solid ones, but were free from fractures, and the operations were rapidly completed. He must also dissent from the observations upon fire bricks. If the clay for such bricks were reduced to an impalpable powder, and by machinery made over dense, they would cease to possess the power to resist the sudden transitions from heat to cold which they were frequently subjected to. Being once consulted by an eminent fire-brick maker on the manufacturing of such bricks by machinery, some tests were made, the result of which was that a burnt brick made of fire clay in the ordinary manner was thrown into a furnace at a white heat, and when raised to the furnace heat was taken out and suddenly immersed in cold water without injury to the brick. A tile made of the same clay (the clay having been first reduced to powder and afterwards made dense by the machine) was subjected to the same test, when it was split to fragments; the reason being that the clay was reduced to so fine a state that the rapid passage of heat was prevented, and hence unequal contraction and expansion arose. The fire-bricks first tested being made of larger or granulated particles of clay, allowed the heat to pass rapidly through, so that this defect did not occur. In the same way it was easy to account for the breakage of glass, pottery, &c., when of considerable substance, by unequal contraction and expansion.

Mr. Charles May, F.R.S., produced a specimen of the American dry brick, which, he said, contained only about half the cubical contents of the bricks generally used in this country. This brick was formed of clay compressed in a dry state. It was extensively used in America, and its density was very great, being only one-ninth less than that of granite.

The Chairman.—Almost metallic.

Mr. May then alluded to a specimen of brick made from London clay, which, he remarked, militated against the statement of Mr. Chamberlain, inasmuch as it was made from clay without any preparation beyond watering and pugging, and was made by Beart's machine. He had also a brick made from the same clay, and compressed and dried. It was, however, imperfect, because, having been set in the kiln with ordinary bricks, the outside had become covered with steam from the evaporation of the bricks, and, therefore, did not present a very favourable specimen. The manufacture of a very beautiful description of brick was being carried on by Mr. Minton from dry clay, and he believed Mr. James Nasmyth had recently patented some improvements. The clay was not, of course, perfectly dry; it was so far re-damped, that if a lump were grasped, it would maintain its form like moulding sand. There were, in the first instance, some difficulties to be surmounted, but they had been all overcome, and a uniformly sound brick was now produced. He did not think the plan of working dry clay would answer in this country. It would not pay to evaporate the moisture from the clay by artificial means, and they had not a sufficient continuation of dry weather to do it, as was the case in America. A very good account of the manufacture of this description of brick was given in Mr. Whitworth's report upon the American Exhibition. Although he did not think that system of manufacture could come into general use in this country, yet, in a dry country, like America, it answered very well. There had been an establishment near Hanwell, for making these dry bricks, but it was now discontinued. The principal difficulty of that plan was the keeping up the corners of the bricks. He himself had taken out a patent for manufacturing perforated bricks with dry clay, but, other avocations interfering, it had not been worked, although he thought it might be used with good results. The principle of the thing was, filling the mould and perforating the brick in such a manner that the clay was squeezed out into the corners, and so reducing the quantity of material required, and giving greater facility for the material to spread outwards, and fill out the corners most completely. With regard to the quantity of material saved in the brick produced by Mr. Chamberlain, it would be found, he believed, not to come up to 20 per cent. The specimen before him, produced by Mr. Chamberlain's machine, was 9 inches by 4½, and contained about 39 square inches. The perforation were not more than 5-8th's of an inch in diameter.

Mr. Chamberlain—11-16th's.

Mr. May took these perforations to be 5-8ths, which would in the aggregate make about six square inches of surface removed; and he thought the saving of material in this instance was not more than 15 per cent., if it even exceeded 12 per cent., and in no case he believed did the saving of material in the perforated bricks come up to 20 per cent. But the disadvantage was, that these bricks broke very much in the carriage when made of the description of clay of the specimens produced; but there were other clays which were not so brittle. There was a white brick made at Mr. Beart's establishment, at Arlsey, which was not so liable to break, the beauty of the colour of which he believed exceeded anything yet produced.

Mr. Henry Clayton would make one or two observations with reference to a portion of the machine exhibited, the important portion of which, he believed, he had the right to say was his own invention, and for which Mr. Chamberlain had taken a license under his patent, —that which he might say gave life to the machine now before them, and without which it would not be a brickmaking machine. He referred to the rollers between which the clay had to pass after leaving the fixed die or moulding plate. The system now in operation, or rather as shown in Mr. Chamberlain's machine, formed the subject of a patent of his (Mr. Clayton's), taken out in 1852. Some ten months after that he obtained a second patent, for a still further improvement upon the same process. It had been his study, for many years, to perfect that class of machine in every detail. As had been stated by Mr. Chamberlain, the difficulty in an expressing machine for making bricks was to produce a stream of clay properly formed with sharp angles, and with a surface fit to be used for building purposes. For the reasons already explained by Mr. Chamberlain, the great friction of the clay upon the sides of the fixed die or orifice, and especially the greater friction in the angles of the orifices prevented the clay protruding from the die. It expressed the clay so badly in some cases, as nearly to separate the stream of clay into two parts. He found that the clay could not be expressed through a die having fixed sides. This led him to contrive an orifice having two of its sides to rotate and travel in the same direction as the clay was being driven. His first means was to make the fixed die of a larger size than the intended size of the brick, and to place it at a conconvenient distance, from a series of rollers, through which it was afterwards to pass. This system was not identically that which was represented in the machine before them. He formed a vortex by using rollers which were connected by endless bands, the clay then having an opportunity of entering much larger than when it left of the finished size. It succeeded to a certain extent satisfactorily, but not completely so to him, and he was, therefore, led to take out a further patent. He found that what he was doing by two distinct means, viz., by a fixed die first, and afterwards by rollers, could be accomplished more simply and effectually by combining the two in one. He then orignated the moulding die, or orifice, with rotating sides, or over and perfectly under, as the case might be, and he found it to succeed. He found it requisite to have some friction upon the sides of the die. If they passed the clay without some degree of friction, in the attempt to overcome the difficulty by having only a fixed die, they found a mis-shapen mass of clay. Having tried a series of rollers without fixed orifices, he found that would not succeed, and it was only by great application and perseverance that he overcame the difficulty. He formed a die having two fixed sides, and also two sides to rotate, and then he considered he had solved the problem of making bricks by an expressing machine, without reference to the particular kind of machine employed. By attaching that system of die they could produce the stream of clay to be made into bricks. The description of clay to be used was a matter for the brickmaker, not for the machine maker. He had, however, paid some attention to the subject of clay; that was indispensable in order to get a good quality of brick, inasmuch as a tough waxy clay was liable to shrink and fracture. With regard to the application of the screw to propel the clay forward, which had been adopted in Ainslie's machine, it would be found that the clay took a circular form, and if they examined the bricks minutely after burning, they would find that they were not sound, but there was a circular fracture in them, which was most objectionable. That was, in his opinion, the great objection to the screw, and led him to abandon it. Instead of adopting that principle, he had formed a chamber within the cylinder of the machine, and at the bottom of the machine—different to all others—not a chamber *under* the machine, but *within* the body of it, and by means of cranks and arms he obtained a continuous delivery of the clay, first from one side and then from the other, and by this means his clay was in a state of rest when being cut. He had found it objectionable to have the clay in motion when being cut by the machine. When it was in motion, unless the boys employed to pass the cutting wires were very active and attentive, the bricks were apt to be cut one-sided. It became his object, as a machine-maker, to remedy that, and, he believed, he had succeeded, and not only so, but he had also accomplished the object of avoiding fractures. He presumed there were many brickmakers present who were more practically acquainted with the subject than he was. A machine for making bricks must be of a large character to be beneficial; the first and most indispensable part of brickmaking was that the clay should be effectually prepared, and, as they were aware, clay could not be handled in a small space; consequently, if there must be space within which a sufficient body of clay could be tempered, they must have a large space to receive the clay to be tempered; hence the machine must necessarily be large, or, at least, the cylinder must be large, and then they had the opportunity of feeding the clay in the manner that was ordinarily practised in the brick-yard, with a tramway and truck similar to a miniature railway, by which means large quantities could be rapidly fed, without which, he considered, a brick-making machine was much at fault. It was necessary that the clay should be put into the machine unpugged, and that the pugging should be done by the machine itself, if they wanted to make cheap bricks, and that was a system very different to the machine before them. As a machine-maker, he would say that, with so small a receptacle to pug and temper the clay, it could not be done properly. He would say, further, with so small an aperture with which to feed the clay—being only about the size of a brick—it was practically impossible to work the machine to produce that quantity of bricks which could be commercially advantageous. It was evident the clay must be made into pieces of a given size, and that he did not call practical brickmaking. The clay ought to be put in by barrow or truck; it should then be carried continuously forward, as was done in the ordinary pug-mill, which was the best machine for preparing the clay that he knew of; and as the proper tempering of the clay was the foundation of good brickmaking the machine ought to do that. This being a matter so imperative, it was one of the first points to which he turned his attention, and he had been more successful in that respect than he could have anticipated. He had tried a great many experiments—some of which failed. The things to be considered were—first, the pocket—and, in the next place, the persons working the machines were not generally mechanics, and, therefore, they wanted a machine which would work without much trouble or attention on the part of the workmen employed at it. The cylinder in his own machine would hold about 1½ cubic yard of clay. With his machine, from 20,000 to 30,000 bricks could be produced per day, varying according to size; which, he believed, was as much as had ever been accomplished by the aid of machinery.

Mr. **Austin**, as a practical brickmaker, bore his testimony to the immense advantages to be derived from machine-made bricks, and also spoke in high terms of the general efficiency of Mr. Clayton's machines, as well as those of Mr. Ainslie's. He confirmed the views expressed by Mr. Clayton as to the necessity for having a large space to collect the clay and the continuous feeding of the machine, and said he gave the preference to machines which would take in from a cubic yard to a yard and a half of clay. There might, however, be an objection to large machines, on the ground that they were not portable; but, generally speaking, he thought a very portable article was not required. He also expressed his approval of the method of cutting the bricks when the clay was in a state of rest, without continuing the propelling motion at the time of the operation.

Mr. C. H. **Smith** said, that a general practice with the hand brickmaker was to sprinkle dry sand in the mould every time previously to filling it with the moist clay. No doubt this plan prevented the inconvenience of the clay adhering to the mould; if this were its only use, any other dry fine-grained powder might answer the same purpose, but he had reason to believe that the sand being quartz or siliceous grains, performed a far more important part in the manufacture of good bricks. First, in the process of burning, the flinty sand found a chemical union with the potash or soda of the clay; this vitreous connection fixed the sand firmly to the surface of the brick. Secondly, in a building, the lime attached itself securely to the sand, which was already fastened to the brick, in the same manner that good sharp siliceous sand, mixed with a certain quantity of quick-lime, after a lengthened period, would become hard, solid mortar. As far as the material alone was concerned, there was but little difference between tiles and bricks; the former were not generally manufactured with a sprinkling of sand externally, and it was well known that a pan-tiled roof could not be permanently pointed with mortar. After two or three years the pointing fell out, separating completely from the tiles, leaving them almost as free from mortar as if the process of pointing had never been performed. On this principle, verified by experiments, he (Mr. Smith) did not consider that any machine could make really good bricks, unless it had some fit and proper method of putting a sufficient quantity of good hard sand on the surface of the article while the clay was in a plastic state.

Mr. **Frederick Lawrence** remarked that Mr. Chamberlain's paper was apt to lead to the belief that London brick-makers generally had set their faces against machinery, and allowed machine bricks to be brought from a distance to London, rather than employ brick machines themselves. This was not the case, as in many brick-fields machinery was extensively used, and numerous steam-engines employed in the different processes of brick making—the clay in some instances being delivered by steam pug mills, in a prepared state, at the moulder's bench. Moulding, however, was still done by hand; as an engineer, however, he knew how anxious brickmakers were to obtain a moulding-machine which would do its work constantly and well. They had heard from Mr. Clayton that he did not invent what he considered a perfect machine until six months ago; it was, therefore, only to be expected that brickmakers would hold back from adopting machinery until they were convinced it was of a perfect character and could be depended upon in all respects. Perhaps Mr. Chamberlain would inform them how long his machine had been at work, and whether it had been found practically to answer. Some brickmakers objected to all machines where the bricks were pressed through dies, because the bricks made by them were much heavier than those made by hand. A thousand of Mr. Chamberlain's bricks would weigh upwards of three tons, while ordinary hand-made bricks would not weigh two and a half tons; thus an addition of 20 per cent. in material and cartage would arise in machine-made bricks. These were serious items to be considered in the question of expense. Mr. Chamberlain's machine could only be worked just as fast as one boy could remove the bricks. An ordinary hand moulder could make bricks nearly as fast as a boy could carry them away, in fact, some moulders made as many as 8,000 to 10,000 per day.

Mr. Chas. May remarked, that he did not know whether it was intended that the discussion should embrace the consideration of machinery applied to brickmaking other than that now before them, but he thought it only right to glance at the very extensive use of machinery in the preparation of the clay in cases where no machinery was used for moulding. He knew that at Rutter's manufactory, down the Thames, they washed their clay so thin, that it was pumped up from 40 to 60 feet in depth, and carried along for a distance of a quarter to half a mile, into vats. In that one ground alone about 20,000,000 of bricks were annually made from this washed clay, and, he believed, they were now sold at 25s. per thousand, delivered on the Thames. They were, perhaps, the finest stock bricks in the neighbourhood of London.

Mr. Norton remarked, that it had been stated that rollers were the only method of making a well-formed brick. Mention had been made by Mr. Chamberlain of the perfect success of Heritage's water-die. He would add his testimony to that statement, having witnessed the operation of the water die, and he believed the bricks were manufactured at one-tenth less expense than was the case with regard to the specimens of bricks now before them. He thought Heritage's system was quite equal to any other in forming a perfect brick.

Mr. W. Dennis said—Having had some years' experience in brickmaking, as well as building, he might be permitted to say that he had never yet seen a brickmaking machine that would make bricks from the surface clay or London loam, mixed as it had to be with ashes from the dust-yards of the metropolis, and that with merely sifting, without grinding, except through a pug-mill. He had seen machines with rotary moulds, both horizontal and vertical, but not one to succeed. He made one himself, with rising pistons, but it did not make good bricks; nor would those that expressed the clay through dies or moulding orifices, and cut off the brick by wires, as the mixture of ashes prevented a smooth, clean cut being made, and would not allow of the free action of the wires. It was not true that the London brickmakers were apathetic. He had known many of them to expend large sums in experimenting with the various patents, and yet all failed. Perhaps the machine by Mr. Clayton, of the Atlas works, had been the nearest approach for making bricks from the London surface clay. He knew the London blue or deep clay would make a good brick by machinery with a mixture of sand; and very good red bricks were made at Sydenham (perforated), but in consequence of their being red, most of the London architects objected to them, although they were perfectly vitrified. He admitted most willingly that the general run of London made bricks were very bad, there being always a great many outside bricks, such as place, shuffs, &c.; but the inside best bricks, known as stocks, were sufficient for all ordinary purposes. Then there were a great many known as burrs, ill-shapen and irregular in thickness; consequently, the joints of mortar were not of even thickness, and, as a consequence, the bond of the work built with them could not be good. Of course, the best stock bricks were not equal to good machine-made bricks from the plastic clays. The worst sorts of London bricks were to be had very cheap, and were used upon buildings where there was no architect or surveyor. As to the desirability of good even-made bricks, there could not be two opinions. The machine now before the meeting, with many others equal, and in some respects superior to it, when set to work in the various plastic clays of this country, would effect a great improvement in brickwork generally. He believed it would be found that the London surface clay or loam would never accomplish that change, by machinery or otherwise.

Mr. Chamberlain said, in reply to the observations which had been made, he must beg to differ from Mr. Beart's remarks—that clays could be too finely ground. It mignt be the case with some class of fire-bricks, but he had always observed that the Stourbridge fire-bricks, which ranked first in the kingdom, were generally much more finely ground than those of other districts, and to this, in some respects, he imagined they owed their superiority. The blue bricks, from the works of Messrs. Heywood, were made from the marls on the table, and would not be of so close and even texture but from the marl being most thoroughly ground. The discussion of that evening had been restricted almost entirely to London brickmaking, and in these districts rollers were, he believed, but little used for the preparation of the clay; but he was still convinced that by their use there would be found a great economy in manufacture, and from the grinding the ashes, or breeze, with the clay, and minutely dividing it, a far superior brick would be produced. By the use of rollers so large a pug-mill was not required, and that was the reason why the pug-mill portion of his machine was smaller than usual. The clay was most minutely divided in its passage through the rollers, and then the pug-mill had merely to amalgamate and compress it, which it effected in a very superior manner. As to quantity—the machine before the meeting threw off the bricks as fast as they could be removed, and this was at the rate of from thirty to thirty-five per minute, with four-horse power. In the use of sand for coating clays, as recommended by Mr. Smith, he thought that gentleman had overlooked the bricks made by this class of machinery. The wire in cutting off the brick, left the flat or mortar joint rough, in proportion to the quality of the clay; and this rough mortar surface produced a face to which mortar or cement would adhere most firmly. He had worked a similar machine to the one before the meeting for the last two and a-half years, and during that time he had not had a single breakage, or any derangement of the machine, which producing a far superior brick to those hitherto made by hand, and in any desired quantity.

The Chairman said they were much indebted to Mr. Chamberlain for his paper. Mechanics had for a long time past turned their attention to the construction of machinery for the purposes of brick making. He thought they could not have a better sphere for the exercise of their ingenuity; for the labour of hand brick making was of the most servile kind, and was considered of so degrading a character that bondsmen and captives, in former ages, were employed in it. Therefore, the introduction of anything that would supplant that kind of labour, and allow a man to turn his attention to more ennobling objects, was deserving of the highest consideration. He begged to move that the thanks of the meeting be given to Mr. Chamberlain for his interesting paper, which having been unanimously accorded,

The Secretary announced that there would be an Extra-ordinary Meeting on the evening of Wednesday next, the 11th inst., when a further paper by Mr. Humphrey Chamberlain, "On the Drying and Burning of Bricks," will be read. On this evening, Joseph Glynn, Esq., F.R.S., will preside.

DESCRIPTION OF A NEW ATMOMETER, OR EVAPOROMETER.

By Arthur Mitchell, A.M., M.D.

(Communicated by Colonel Sykes, F.R.S.)

That branch of climatology which has reference to the humidity of the atmosphere, is scarcely second in importance to the thermometric or barometric phenomena. Yet few climates, as regards this constituent, have received a full investigation. The hygrometer of Regnault or Daniell, or the wet and dry bulb thermometers, furnish us with information on one aspect of the question. But there are others, and to one of these the instrument I am about to describe has reference. It does not deal with the amount of vapour in the atmosphere, nor with its bearing to the point of saturation, but shows the amount of water which the atmosphere, whether calm or in motion, *does actually*, or rather *can actually*, take up or convert into vapour. The determination of the dew point does not determine this. An atmosphere in motion, nearer the point of saturation, will take up more water than one further removed from this point which is still. Like the rain-guage, then, the atmometer is a supplement to, and not a substitute for, the hygrometer.

The particular fact which it elicits is one both of interest and practical importance. This has long been felt and admitted, and various instruments have been invented for measuring the rate of evaporation. Dr. Buist, in his meteorological notes, gives the fullest account of them which I remember to have seen. They consist generally of a simple saucer, modified in various unimportant details, of known area, with a scale at the side to mark the height at which the fluid stands, or attached to a balance, by which the loss is from time to time ascertained.

Among some of the objections to these there are the interference of the falling of rain or dew, and the difficulty of determining the quantity evaporated when it is very small, and, as the consequence of this, the quantity carried off during short periods.

Having practically experienced these inconveniences, I was led to construct the instrument of which I subjoin a section, and which, I think, supplies in a great measure the desiderata.

It consists of an evaporating dish, the losses in which are supplied, as they occur, from a reservoir, whose area is ten times, or any other given number of times, less than that of the evaporating dish.

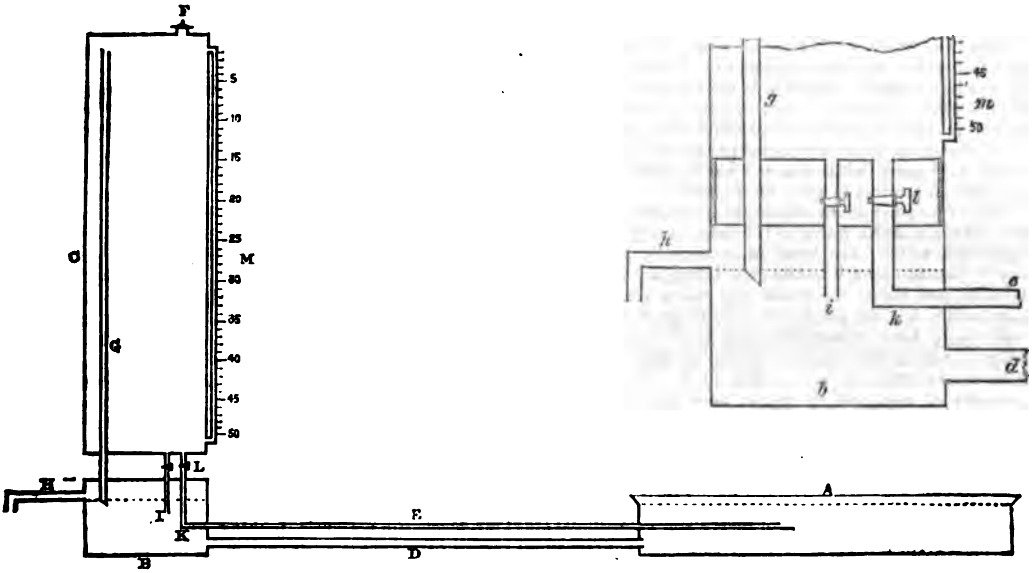
Its general principle is the same as that involved in the simple fountain inkstand, or the fountain drinking-cup of the bird's cage.

The details of its construction are best illustrated by the diagram.

The tube, D, connects the flat basin, A, to the smaller but deeper basin, B. Water will stand, therefore, at the same level in B as in A. Let us suppose both filled to the level of the dotted line.

The stop-cocks at L being then shut, let the cistern, C, be filled with water at the screw opening, F. If now the cup is firmly screwed down, so as to make it air-tight, and the stop-cocks opened, it will be seen that the water will not flow out of the cistern till the level of the water in A and B is depressed.

Fig. 1.



This is clearly the case, for the tubes G, I, K, which communicate with its interior, have their openings below the water, and no air can enter. In fact, the cistern becomes the parallel of a jar standing in a pneumatic trough.

But suppose the level of the water in B to be lowered, then the mouth of the tube, G, which may or may not be carried up to the top of the cistern, admits air, and the displaced water flows out by I and K.

But the water which has thus escaped raises the level again, and so shuts the mouth of the tube, G, and then all remains stationary till a further depression of the level, when the same process is repeated.

A hydrostatic valve is thus obtained, simple, liable to no derangement, and acting with sufficient delicacy.

It will be observed that there are two outlet tubes (I and K), one of which opens into B, and the other into A. This is not essential, but its object is as follows:—When the whole escape takes place into the smaller basin, B, a trifling outflow raises the level temporarily and shuts the tube, G, but, as part of this flows into A, by the tube D, in order to adjust the level, as soon as it is spread over so large an area it practically becomes nil, and G is again opened, and so on, by small jerking escapes, till the equilibrium is established. To obviate this in some measure I have the two outlets, one of which, the larger, is prolonged directly into the evaporating dish itself. To be strictly accurate, the bore of the one tube should bear the same ratio to that of the other which the area of B does to A.

The motion of the water in A, caused by the wind, is not communicated through the long tube to B in any degree to interfere with the working of the instrument. Suspecting that this might be the case, I had devised a method of obviating it, but I found it unnecessary.

It is evident, then, that the water will always remain in A at the same level, that of the dotted line; for, as the water is carried off by evaporation, it is at once replaced by a supply from the cistern. This permanent or fixed level, to be acted on by the atmosphere, adds to the accuracy of the indication.

It is also clear that for every 1-10th of an inch evaporated, one inch will fall in the cistern, or otherwise if the areas are to each other in different proportions. This is read off on the glass tube which runs up the outside of the cistern, M; but, before taking the reading, it will always be well to place a cover for a minute over the evaporating basin, so that all the fluids may be at perfect rest.

But should rain or dew fall, and raise the level of the water in A, what will be the result?

That in B will proportionally rise, but the outlet of the tube, G, is exactly on the same level as the orifice of the tube, H, and by it, therefore, the water immediately flows away when it exceeds the level of the dotted line.

The instrument could thus be made to serve, at once, as a rain guage and an atmometer by connecting the tube, H, to some reservoir whose area bore a known proportion to that of A. In such a case, the lip of the atmometer would require to be somewhat differently constructed.[*]

Of course the instrument does not mark the evaporation which may occur while rain is actually falling, but this is so small an error as to be of no moment.

One of a rather more important character arises from the adhesion of the water to the sides of the tube, G, to overcome which, the level must actually fall slightly lower than the mouth of the tube before air is admitted. If, then, just before the break has taken place, a fall of rain occurs, a small portion of it would go to replace what had really been evaporated, and thus would entail an error. Again, the same adhesion of the water to the tube would influence the overflow by H. If a very small quantity of rain fell, it might raise the level actually above the level of H, but not sufficiently so as to overcome the capillarity and cause an escape. It would then remain and be carried off by evaporation without being indicated on the scale. These are both errors, but not grave ones. They can be overcome, however. It might be done by an arrangement of levers and balancings, producing a great difference of level in B, by a very small change in A. The complication, expense, and liability to derangement are the objections to this.

Another method of accomplishing the same end is simple, and without the faults of the preceding. It was suggested to me by my brother, Mr. James Mitchell. In it the tube H is connected with a pluviometer, as already pointed out, the whole apparatus being elevated about 3 feet above the general level around. The aperture of an ordinary pluviometer, identical in size with that of the evaporating basin, is placed at the same level, and as close together as may be deemed consistent with accuracy. It will be at once seen that the difference of the readings of the two pluviometers will show the error to be added or subtracted, as the case may be, to or from the reading of the evaporometer. The additional trouble will be slight, since one pluviometrical reading has at any rate to be taken.

Practically, I am of opinion that the error would be so small that it might be left without attention. But I have thought it right to point it out, and show how it may be corrected, by a method, too, which adapts itself perfectly to the exact nature of the error in each individual instrument, however modified in its mechanical arrangements.

The following sketch (see next page) exhibits the combination of the pluviometer and evaporometer, with the correcting pluviometer also attached, and some minor mechanical alterations which I owe to the same source.

EXPLANATION OF THE SKETCH.

A, B, is a stout post, fixed in a garden or other suitable place.

C, D, is another post, fixed at a convenient distance (say 6 feet), and in an open place, not overshadowed by trees.

The *evaporometer*, E, F, and the *pluviometer*, G, H, are attached by lugs to the cross arms of the post, C, D.

The cylindrical *reservoir*, I, J, of the evaporometer is attached by lugs with oblong slots to the post, A, B, and its level is delicately adjusted by the screw-bracket at J.

A *pneumatic well* is attached to the bottom of the *reservoir*, I, J, and the air-cock, *a*, the waste-cock, *b*, and the supply-cock, *c*, are shut and opened successively when the reservoir is replenished (by the air-tight cock at I), in such a manner as not to disturb the water-level in the evaporometer.

The water from the well is conveyed by the india rubber, gutta percha, or gas-pipe tube, *c,d,e,f*, to the evaporating dish, K, L, *which thus always contains water at the same level.*

When rain falls the evaporometer dish overflows by the small tube *at g into the subjacent cylinder*, M, N.

In order to prevent high winds causing an erroneous overflow by the tube at *g*, it is covered by a cap, which is one inch external diameter, and pierced with small holes in its lower edge, intended to admit of a gradual overflow from an actual rise of level in the dish, but prevent the action of waves raised by winds from being felt within the interior of the cup. An enlarged sketch of the cup and overflow tube is shown at O, P. It has a bottom with a hole in it to admit the small pipe, and a perforated diaphragm a quarter of an inch below the water-level, through which also the overflow tube passes. By these means the cap is retained firmly in its place. The top of the cap stands about 3-16ths of an inch above the water-level.

The reservoir of the evaporometer is 4·9 inches inside diameter, and the dish of the evaporometer 11 inches inside diameter, which, deducting for the cap (1 inch external diameter), makes the surface of the exposed water in the evaporating dish just five times the area of the interior of the reservoir, making every five inches in the small glass tubing scales represent one inch in the dish of the evaporometer.

The cylinder of the simple pluviometer, and also that of the combined pluviometer and evaporometer, are 4·93 inches inside diameter, both exposing an area of 11 inches diameter to the action of the falling rain. The cap in the evaporometer, standing in the centre of the dish, only 3-16ths of an inch above the water level, and more than half an inch below the level of the lip, will not prove an interfering cause.

R is a section of the reservoir through the water level.

The pipe, *c d e f*, is to be carefully laid with a regular

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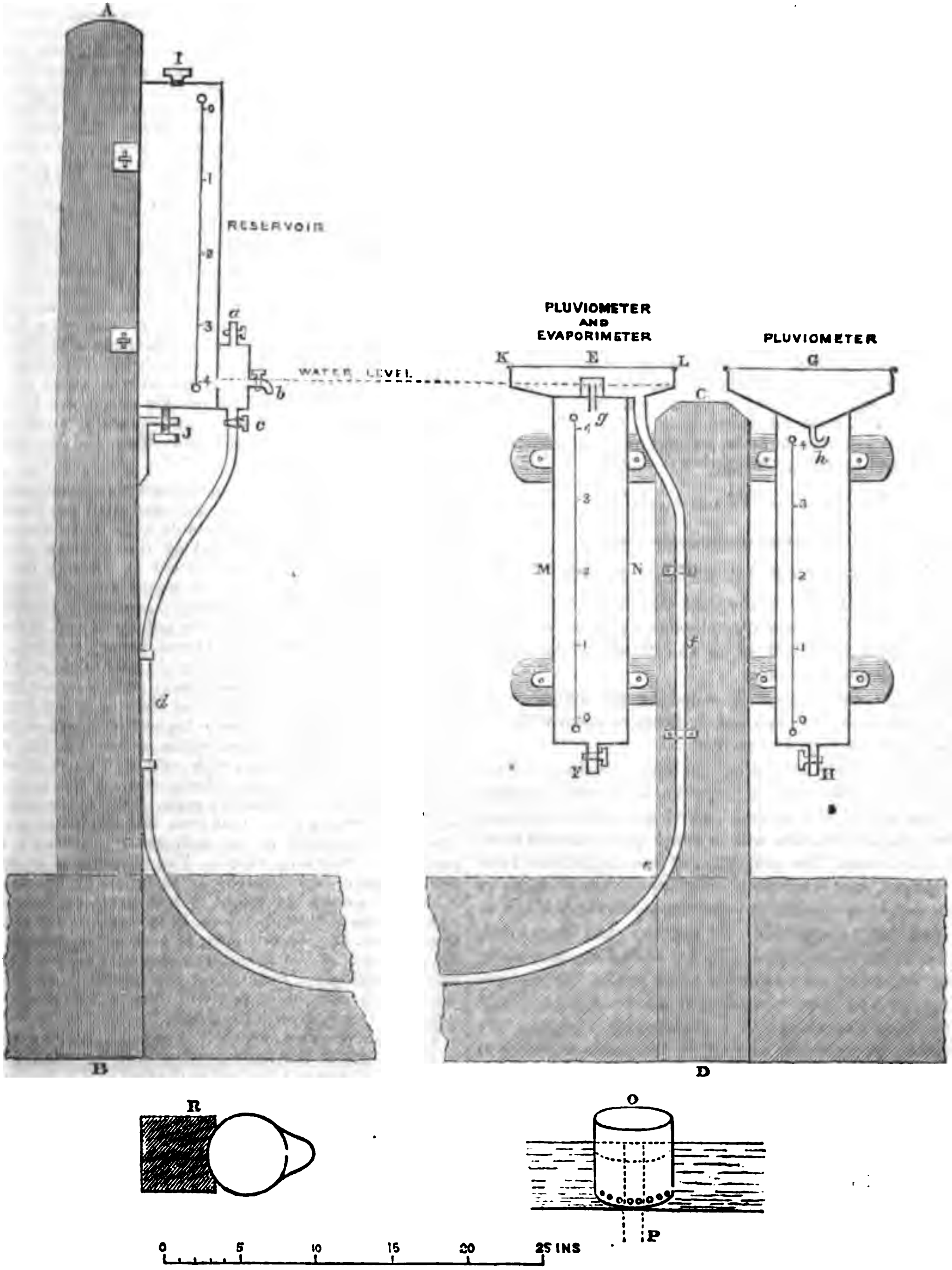
[*] The instrument, as described below, is at present being constructed by Casella & Co., 23, Hatton-garden, and will be placed on the table for inspection at the next meeting of the Society.

Fig. 2.



rise on each side from the lowest point, so as to prevent the lodging (by disengagement) of air in any irregular bend.

The rain is admitted into the pluviometer cylinder by a small hydrostatic trap at *h*.

The overflow cylinder of the evaporometer is theoretically a pluviometer, but any difference found in practice between its indications and that of the pluviometer, will shew what corrections, if any, must be made on the indications of the evaporometer reservoir, in consequence of capillary attraction minutely affecting the operations of the water level, or in so far as the action of high winds may occasionally induce a slightly excessive overflow.

The dishes of the evaporometer and pluviometer need not be fastened to their subjacent cylinders, but may be made easily removable, and fitting tightly only by a faucit and socket-joint.

The waste-cocks at *b*, F, and H, are useful for adjusting levels before commencing a series of observations.

The whole of the apparatus, except the post, cocks, and tubing, may be made of tinned iron or zinc, and of cheap and easy workmanship, having wires inserted by a common process in the open edges of dishes and cylinders to keep them stiff and circular. It might be constructed so that the cylinders would go into one another, like a nest of pill-boxes, so that the whole might be packed up in a small volume for carriage to any place, where a post could easily be found on which to erect it.

The post, A, B, might be dispensed with, and the reservoir mounted on a slender perpendicular continuation of the post, C, D. This, in some winds, would bring one or other of the dishes too much under lee of the reservoir, but (by lengthening the cross arms of C D so as to admit of the cylinders being set more apart) it is probable that the error so induced might be reduced to a very trifling amount, and the instrument would be rendered more unique and compact, and sufficiently, though not quite so free of error, as by the plan of keeping the reservoir at a greater distance.

By the following formulæ an area may be reduced or augmented by any given number of times—

$$D = \sqrt{d^2 n} \text{ and } d = \sqrt{\frac{D^2}{n}}$$

MEANS OF ARRESTING FIRES.

Mr. D. J. Murphy, of the Cork Chamber of Commerce, in a letter to the Secretary, describes a plan for arresting fires, which he submitted to the Board of Admiralty above a dozen years since.

The process proposed is stated by the author to be simple and effectual, and not to interfere much with the machinery employed at present.

"It is simply saturating the water discharged from fire-engines with a certain proportion of chloride of sodium (common salt) and potash, both cheap articles; and, indeed, the former alone will be found quite effectual in all ordinary cases. The proportion of these ingredients to be employed may vary from one-tenth to one-thirtieth of the weight of the water so discharged, of which it will be found that a considerably less quantity shall be required, from being so saturated. In low elevations, and where the flame has not reached a great height, the stronger impregnation may be used with advantage; but when the flame has arrived at a considerable elevation, the weaker impregnation can only be employed, arising from the greater resistance of the air, the increased weight of the materials, and the augmented difficulty of the stronger impregnation passing through the valves of the fire-engine; though, even then, it can be successfully discharged to attack the flame at its root or base, which is, perhaps, the best course to adopt in all cases. A fireman, in his ordinary dress, and simply armed with an elastic tube conveying this stronger impregnation, may boldly and securely face the strongest and fiercest flame, and make himself a passage through it, by commencing cautiously at first to discharge the impregnation on each side of him; for, where it falls, it not only subdues the flame, but, by leaving a coating of the materials, it prevents it from readily catching again the substance on which it previously fed; the result being, that the muriatic acid becomes volatilised, and flies off, while the soda, which is indestructible, is converted into a glaze on the surface. The root or base of the flame is therefore the point to which the force, power, and efficacy of the impregnation ought always to be directed.

"This impregnation, it is to be observed, can be so managed, by the addition of other ingredients, when found necessary, or where the expense is disregarded, such as the diluted mineral acids and their salts, as to produce a temperature approaching, and even considerably below, the freezing point on Fahrenheit's scale, and yet preserve its fluidity; for it is by its chemical combination it acts against the flame, and also in serving to reduce the temperature of the surrounding heated atmosphere. The effect of several engines acting at the same time, by the weaker and stronger impregnations, must be all powerful, as may be easily conceived; and no fire, whatever degree of head it may have previously attained, can resist the power and efficacy of this impregnation for any period exceeding half an hour. Even water, saturated with finely powdered clay, chalk, slacked lime, &c., all cheap articles, and slow conductors of heat, may be employed with great advantage on flames of low elevation; for it is to be impressed that water is alone used as a medium for conveying these substances, as well as the others, to the body of the flame, or rather to its source—such as the substance on which it feeds. Let this be completely coated with those ingredients; for the water will be quickly evaporated by the intense heat, and the effect sought—namely, the extinction of the fire—will be the immediate and necessary consequence. * * * * *

"If the increased expense of the new plan be estimated, it will be found insignificant, compared with the benefits it will confer, and the innumerable evils and calamities which will be prevented. Taking the average of the quantity of the ingredients required as forming one to twenty of the weight of water, it would amount to about 400lbs. weight of salt and potash to saturate sufficiently, say 800 gallons of water; and the estimated cost of these ingredients would not much exceed twenty shillings, an expense no insurance company would withhold, with the certainty of saving from destruction perhaps some thousands of pounds, and probably the lives of a few human beings. But this is the very highest estimate of cost, for from some small experiments made by the proposer of the plan, he found with only 4.10 parts of common salt to 95.90 of water, which reduced the temperature to 27.8 on Fahrenheit's scale, fully three degrees below the freezing point, that even this slight impregnation was discovered to be sufficiently effectual, and produced a surprising effect. The proportion is, however, always to be regulated, not so much by the height of the flame, as by the height of its source, or the materials on which it feeds. This is generally not higher than the 1st, 2nd, or 3rd floor of a dwelling house, and the proportion of the specified ingredients may be regulated accordingly. But, taking the quantity as before, above 100lb. weight of salt will thus be conveyed and spread over each floor of the house.

The same principle, which it is evident solely depends on the efficacy of the impregnation, may be carried into effect in subduing and dissipating the foul and inflammable air which is sometimes generated in the old workings of coal and other mines, and which so frequently leads to the destruction of many lives. Any necessary strength can be given in this case to the impregnation, and it will have the same beneficial result by purifying and neutralising the baneful effects of this fatal and inflammable gas, for which purpose it will be requisite to employ a small garden-engine to saturate those places where Davy's lamp indicates the existence of this destructive gas."

The author also states—

"That he considers it is possible to extinguish fires, more especially at the commencement, and of low elevation, without the employment of either water or fire-engines, merely by discharging, by means of a simple machine, finely-powdered clay, lime, chalk, &c., assisted by the air, through a tube, on the blaze or flame."

ON THE PURIFICATION OF POLLUTED STREAMS.

By F. Crace Calvert, F.C.S., &c.

In consequence of the interesting paper read by Professor Clark, M.D., before the Society's Ordinary Meeting of the 14th of May, "On Means available to the Metropolis and other places for the supply of water free from hardness and from organic impurity," I beg to forward you the following remarks, which I hope will prove interesting to the members of our Society. It will furnish another important instance of the value of lime for the purification of water as first established by Professor Clark, and subsequently applied by Messrs. Higg and Wicksteed to sewerage waters. They will be found to contain some information respecting the remarks made at the meeting by the chairman and by the Rev. J. C. Clutterbuck, respecting the removal of organic matter in solution from polluted water.

Having often reflected on the source of diseases generated by the effluvia from the highly polluted streams which pass through most of our manufacturing and densely populated towns, as was exemplified in Manchester, in the neighbourhood of the river Medlock, during the visitation of the cholera in the years 1832, 1849, and 1854, I thought it my duty to draw the attention of the Sanitary Association of that city to the importance of trying to find out means of decreasing or removing the above source of public nuisance. At their request I began, during the autumn of 1854, a series of experiments, the results of which I have laid before them in two reports.

I am induced to publish some of the facts contained in these reports, as they are, to the best of my knowledge, *the first* which have been obtained in experiments on a large scale with a view to removing *organic matter in solution and suspension in a running stream similar to the Medlock;* for the experiments made by Messrs. Higg and Wicksteed, and Professor Clark and Mr. John Graham, on this subject, have especial reference to the removal of these substances from water when confined in reservoirs, or settling lodges, and not in a constant moving mass of water such as the Medlock, on which I operated.

I shall arrange my remarks under four distinct heads, viz.:—

I.—Laboratory Experiments.

Having procured some of the black and fœtid water which is constantly flowing down the Medlock, I added to separate portions various chemical substances, and found that lime, as proposed by the above-named gentlemen, or the disinfecting powder of Dr. Angus Smith and Mr. McDougall, was the cheapest and best material that I could employ; for, when lime is added to the water, it combines with the organic matter and the excess of carbonic acid in solution in the water, and the flocculent precipitate thus produced falls rapidly to the bottom of the vessels in which the experiment is made, leaving a clear transparent fluid.

I further remarked, that the odour had nearly disappeared, which is a matter of high consideration, as the quantity of gases produced by the putrefaction of the organic matter deposited in the stream, is enormous; and, although these gases may not be the real source of disease, still they accompany the miasmata which are the direct cause of injury, and are, probably, the means employed by nature to warn man of the presence of danger. I may here state, that afterwards, when the process was carried out on a large scale, the same effects were obtained.

After many trials, I found that two or three grains of hydrate of lime per gallon were quite sufficient to produce the above results.

II.—Composition of the Water of the River Medlock, and the Action of Lime in Purifying the same.

Before describing the chemical action of the lime on the substances in solution and suspension in the river Medlock, it is necessary that I should give the composition of the water which was operated upon on a large scale.

Composition of the Water of the River Medlock, taken above Manchester, and before it has been polluted to any extent, as compared with the same water when it has passed through the town.

	Before passing through the town.	After passing.
Organic matter per gallon	4.20	8.40
Mineral do.	36.75	32.90
	40.95	41.30
Salts of Lime:		
Chloride	none	none
Sulphate	very abundant	very abundant
Carbonate	exceedingly abundant	exceedingly abundant
Salts of Magnesia:		
Chloride	rather abundant	rather abundant
Sulphate	exceedingly abundant	exceedingly abundant
Carbonate	very small quantity	small quantity
Salts of Potash:		
Chloride	small quantity	large quantity
Sulphate	rather abundant	rather abundant
Salts of Soda:		
Chloride	rather abundant	rather abundant
Sulphate	very abundant	very abundant
Salts of Ammonia:		
Nitrate	traces	traces
Carbonate	traces	traces
Salt of Iron:		
Carbonate	abundant	very abundant
Phosphoric Acid	traces	traces
Silica	traces	traces

The difference in the amount of mineral matter is doubtless due to the water having been taken at different times.

The only point of interest in the above analysis is the remarkable fact that this water contains a large amount of sulphate of magnesia, the presence of which salt I have constantly met with in the numerous Lancashire waters which I have analysed.

But, with reference to the nature of the water which I intended to operate upon, I thought it advisable to take samples from the river during several days, and to ascertain the quantity of matter in suspension, the quantity of organic matter in solution, and the quantity of mineral matter per gallon; and the following are the results obtained:—

Table No. 1.

No. of Experiment.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Grains in suspension per gallon	5.62	6.18	6.40	6.70	8.36

I found the above quantities to consist of—

Organic matter	53.69	per cent.
Inorganic	56.31	
	100.00	

The quantity of matter in solution was represented by:—

Table No. 2.

No. of Experiment.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Organic matter per gallon	8.40	6.65	7.35	10.85	9.45
Inorganic ditto	32.90	20.30	21.35	20.65	22.75
	41.30	26.95	28.70	31.50	32.20

These figures clearly show the large proportion of organic matter which the water contains in suspension and solution, and give a clear insight into the source of the noxious effluxia which the river is constantly emitting; but what renders these figures especially interesting, is, that they enable me to show the exact action of Lime when applied to such waters, as shown by the following Table:—

TABLE No. 3.

Composition of the water of the Medlock after treatment with Lime—

No. of Experiment.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Organic matter per gallon	3.5	2.8	4.2	3.5	3.5
Inorganic ditto	26.6	25.2	22.4	15.4	21.7
	30.1	28.0	26.6	18.9	25.2

It is chiefly in comparing this table with No. 2, that the value of lime in purifying the water of the Medlock is clearly demonstrated; for it does not only remove the dirty black matter in suspension, and consequently clarify the water, but it also removes the greater part of the organic matter in solution, for we find that if we take the total average amount of organic matter in suspension and solution, as 12.11 [qy. 8.54] grains per gallon before applying the process, there remains, after the application of the lime on a large scale, and directly added to the river, only 3.5 grains per gallon of organic matter; or, in fact, a quantity less than exists in many river waters which are used for domestic purposes; but I do not mean to state that this water could be used as a human beverage, for it gave, on evaporation, a nitrogenated residue. I also analysed the deposit produced by the action of lime in the running stream, wishing to ascertain if such a deposit would be sufficiently rich to prove a valuable manure, and thus tend to diminish the expenses attending the application of the process, but it will be perceived, by examining the figures in the following table, that its value is comparatively small, and that it could only be applied to certain kinds of land, and in the immediate vicinity of the stream:—

TABLE No. 4.

		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Organic matter	Vegetable	22.01	20.47	18.07	17.17	19.81
	Animal...	4.89	4.73	4.89	5.15	5.59
Phosphoric Acid		.56	.60	.68	.68	.56
Matter insoluble in Acid.	Silica abund. Sulph. of Lime very small quantity... ...	10.98	7.76	8.80	9.76	11.04
Matter soluble in Acid.	Carbonate of Lime, exceedingly abundant Carbonate of Magnesia small quantity. Oxide of Iron abundant. Alumina traces Manganese traces.	61.56	66.44	67.56	67.24	63.00
		100.00	100.00	100.00	100.00	100.00

I have analysed the manure sold in bricks at Leicester, and produced by addding lime to the sewerage water of that town by Messrs. Higg and Wicksteed, and find it to have a very similar composition, viz.,

Organic matter	16.89
Water	3.91
Lime....................................	32.52
Magnesia	1.52
Iron and alumina	8.90
Carbonic acid	24·46
Silica	11·82
Sulphuric acid......................	·24
	100·26

I also analysed the natural deposit which is constantly forming in the River Medlock, and, to my astonishment, found that it was still poorer in organic matter, as will be seen in the following analysis. This is no doubt due to the fermentation and putrefaction which are constantly going on in the deposited mass.

	Organic matter	18·600
Soluble in water	Sulphate of lime	1·006
	Do. potash	·800
	Chloride of magnesium... Do. sodium.........	·544
	Silica	1·000
Soluble in acid	Phosphoric acid	·200
	Peroxide of iron	4·020
	Alumina	4·530
	Carbonate of lime	8·250
	Sand	66·050
		100·000

It is possible that the presence of phosphates, which is noticed in this deposit, is due to a certain amount of sewerage water which the river receives during its course through the town.

III.—METHOD WHICH WAS ADOPTED TO APPLY THE PROCESS.

Before applying on the whole of the Medlock, the process which will be hereafter described, it was thought advisable to only purify a portion of the water which was necessary to supply the Bridgewater Canal, and to effect this the following apparatus was devised by C. E. Cayley, Esq., C.E., and constructed at the expense, and under the superintendence, of the Bridgewater Trust.

1st. The water of the Medlock is admitted into the canal at Knott-mill, and passes underneath two archways, and thence along two basins—the basins being continuations of those formed by the archways.

2nd. The quantity of water so admitted is regulated by permanent sluice-gates, placed across the stream at the higher end of the archways; the water not required passing away through an overflow basin into a tunnel, which conveys it into the river at a point lower down.

3rd. The larger of these basins under the archway and warehouse was employed for the experiments.

4th. The construction of the apparatus was as follows:—

I. Two wooden vats, each thirteen feet square and three feet ten inches deep were placed over the overflow, and near the side of the river. In the vats the lime was mixed with water.

II. From each of these vats the solution of lime was discharged at pleasure into a trough, having a perforated bottom, and which extended across the Medlock at an elevation of several feet above the water.

III. About 12 feet higher up the river than the permanent sluices, a dam was constructed above the stream, forming a weir, over which the water had to flow into the depositing basin, and was so placed that the solution of lime falling from the perforated trough mingled with the river water as it passed over the dam.

IV. To regulate the quantity of water operated upon, a series of slides was fixed along the top of the dam, which could be raised or depressed at pleasure.

V. At the opposite end of the basin another dam was fixed across the canal, the top of which was about eight inches below the top of the dam in the Medlock.

VI. The space between the two dams thus became a separate basin, about 142 feet long, 27 feet wide, and 8 to 10 feet deep, divided into two compartments of very unequal size by the permament sluice gates.

VII. The water, therefore, passed over the upper dam, where it received the lime into the small compartment, whence it passed underneath the permanent sluice gates into the larger one.

5th. The isolation of the depositing basin was, however, rendered imperfect: firstly, by the managers of the canal letting the river water into the smaller compartment at times when the experiments were suspended, for the purpose of supplying a water wheel; and secondly, by the contents of a sewer entering beneath the warehouse.

Before giving some of the results arrived at, and also to explain the difference between the results of laboratory experiments and those actually obtained at the river, it is necessary to state that the above apparatus, being only a temporary one, was far from perfect in its construction, and that consequently a large quantity of non-precipitated water was constantly running into the reservoir, and thus rendered the experiments less conclusive than they would otherwise have been. The two following experiments are taken out of a series:—

	Height of the Water as it passed over the Weir.
No. 7. 10 cwt. of lime put in the mixing tank, Began at 11·0, stopped at 3·15. Guage all the time. Water used to mix lime, 6,620 gallons. Water purified, 467,606 gallons.	2 1⅝ 1⅝ 1¼
No. 9. 10 cwt. of lime put in the mixing tank. Began at 8·45, stopped at 1·10. Guage all the time. Amount of water used to mix the lime, 5,178 gallons. Water purified, 485,944 gallons.	2 1⅝ 1⅝ 1¼

Therefore, from these results it is clearly seen that, with ten cwt. of lime, about 500,000 gallons of water were purified; and there is no doubt, in my mind, that if the mixing of the lime with the water had been more perfect, and the lime had had more time to act, as would be the case were the plan adopted on the whole stream, a much greater quantity of water could be purified; in fact, there is no reason why the quantity of lime, viz: two or three grains per gallon, which was found sufficient in the above-cited laboratory experiments, should not prove equally efficient when applied to the whole stream; and if this conclusion were to prove correct, then the following general deductions could be considered as proved, viz., that it would require only about three cwt. of lime to purify 1,000,000 gallons of water of the river Medlock, and if this were the case, as it is estimated, that the average flow of the river Medlock is about 16,000,000 gallons per day, the quantity of lime required to purify and deodorize it to a practical extent would be about 2¼ tons of lime per day; which, considering the benefit it would confer on the inhabitants at large, cannot be considered as an expensive and impracticable process. It must be borne in mind that this plan could be more easily applied to small streams of a similar nature, which flow through such towns as Bolton, Oldham, &c.

There is also another consideration which should have weight with the inhabitants of such towns, viz., that this mode of purifying water similar to that of the Medlock, would prove of great advantage to manufacturers who use it to supply their boilers, for the amount of mineral matter, as shewn in tables, Nos. 2 and 3, remains nearly he same; and, consequently, the lime process does not ncrease the amount of mineral matter in the water; and f the composition of the deposit thrown down by the ime be considered, the advantage of the lime process ecomes evident, for I find in the deposit (see table No. 4) hree substances, viz., organic matter in large quantities, xide of iron in large quantities, and sulphate of lime, which three matters are liable to prove most destructive o boilers; whilst water merely containing a little lime will not prove injurious, and any chance of incrustation would be prevented by adding to the water supplying the oilers a small quantity of sal-ammoniac, as recommended y Dr. Ritterbandt.

IV.—Method Proposed for Applying the Lime Process along the Course of a Stream.

The plan which I propose consists in taking advantage of a general law which water presents when running in a stream, viz., that the matter in suspension carried by such waters is deposited near the angles and curves, and within the still-water line of the stream, which is always opposed to the larger or external curve, and in having small reservoirs, the size and position of the natural deposit beds within the still-water line, so that when the natural matters in suspension, or those produced by the lime, flow down the stream they will naturally settle in these tanks, and as those tanks would be numerous along the course of the stream, the deposit which might escape one tank would probably, in a great measure, be gathered by the second. The efficiency of these tanks would be increased by the application of the lime process, owing to the fact that the curdy precipitate produced by this substance in such waters, separates, and falls with extraordinary rapidity, for it was remarked in the course of my experiments, that immediately on the addition of the lime the water was decolourised, and that it became transparent in a few minutes, whilst the natural water does not become clear until after standing several days.

To apply the lime I would propose that at several hundred yards above curves the best adapted for establishing the above-mentioned subsiding tanks, barriers should be thrown across the stream, with openings, so as to retain the lime without materially impeding the flow of the water. Behind these barriers I would place a layer of lime, the thickness and renewal of which would be regulated according to the flow of the stream. The matter in suspension in the water, so coming in contact with the lime, would be carried down and deposited in the still-water line, or in subsiding tanks occupying its position.

Home Correspondence.

REMARKS ON PROFESSOR CLARK'S PAPER ON THE SUPPLY OF WATER FREE FROM HARDNESS AND FROM ORGANIC IMPURITY.

Sir,—I find by your *Journal* of the 23rd instant, that Mr. Dugald Campbell has impugned the accuracy of the analyses of different waters submitted by me to the Society of Arts, and also takes objection to the conclusions I deduced therefrom.

I do not propose to quarrel with Mr. Dugald Campbell for the tone he has adopted, because the discussion of a question of science ought not to be encumbered with personalities. I shall therefore confine myself simply to explanation, to facilitate which I propose to divide the fifteen examples I submitted into five compartments of three each.

The Table of Analyses complained of by Mr. Dugald Campbell contains fifteen examples, thirteen of which were published *six years ago*, in a table, with my evidence, in the Report by the General Board of Health, May, 1850; the remaining two examples, newly introduced, are the analyses of Mr. D. Campbell and the statement of Dr. Clark. Further, of the whole fifteen examples, twelve are from the "so-called chalk water," and of the twelve four are from the same well in Trafalgar-square. The remaining three examples are from so-called pump spring water, and which were introduced, be it remembered, *six years ago*, for the purpose of drawing the attention of the honourable members of the Board of Health to the large predominance of the carbonate and sulphate of lime in what was then and is still considered to be "*pure spring water.*"

As the accuracy of thirteen of the examples of the fifteen had not been questioned by Mr. D. Campbell, or any other chemist, for a period of *six years*, I think I had a right to reproduce them as correct, but as Mr. Campbell now objects, I submit the following explanation:—

On reference to the table I presented to the Society of Arts, it will be seen that the first three analyses in the first compartment are stated to have been made by Professor Graham, in 1844 (fourteen years ago), and were then ordered by the Commissioners of Greenwich Hospital through me. I have before me a copy of Professor Graham's report with the analyses of the three waters, which is as follows:—

"The waters of the three wells is decidedly hard for deep wells in which the water comes from below the deep clays, being harder, by one-half at least, than Thames water, &c.

"Several of the deep wells about London, which I have had the opportunity of examining, are softer than Thames water, and the only reason I can give for it is—their greater depth than the Greenwich."

(Signed) "Thomas Graham."

Statement of the analyses, as published by Mr. Braithwaite, to the General Board of Health.			Analyses of Three Chalk Waters, by Professor Graham, in 1844.	Statement of the analyses in Mr. Braithwaite's Table, Society of Arts Journal, May 16, 1856.		
Greenwich Brewery.	Page's, Greenwich.	Lambert's, Deptford.		Greenwich Brewery.	Page's Brewery.	Lambert's, Deptford.
Grains	Grains	Grains		Grains	Grains	Grains
19·08	21·23	16·74	... Carbonate of Lime ...	19·08	21·23	16.74
0·52	nil.	nil.	... Carbonate of Iron ...	nil.	nil.	nil.
nil.	nil.	0·80	...Carbonate of Magnesia...	nil.	nil.	0·84
2·04	2·88	2·75	...Sulphate of Magnesia..	2·04	2·88	2·75
3·62	0·62	2·67	......Sulphate of Soda......	3·62	0.60	2·67
0·37	3·12	1·91	... Chloride of Sodium..	0·37	3·12	1·91
1·67	nil.	1·33	.... Loss	1·67	nil.	1 33
27·30	27·83	26·24	.... Total	27·30	27·83	26·24

The only error in the above three analyses is the omission of the carbonate of iron in the Greenwich well water, viz., 0.52 grains in the gallon, and which, if added to the column or table submitted to the Society in 1856 will make that addition correct.

The second compartment in the table consists of three analyses made by Mr. Brande in 1846, now ten years ago, and, as before stated, were published by me six years ago. I took these analyses from published documents. On reference to the water of Trafalgar-square, in my table of 1856, I find the solid contents are stated at 66.1 grains to the gallon, there being 59.9 grains of soda salts, 3.1 grains of carbonate of lime, 2.4 grains of carbonate of magnesia, and 0.7 grains of silica. The accuracy of this analysis is confirmed by Mr. Dugald Campbell himself, for I find in his printed Report on the Source, &c., page 2, line 23, the following:—

"According to Mr. Brande, in 1846, the solid contents per gallon were 66.1 grains, consisting of 59.9 grains of soda salts, 3.1 grains of carbonate of lime, and 2.4 grains of carbonate of magnesia." This gives as under:—

Mr. Braithwaite's Table, 1856.	Trafalgar-square Well Water, by D. Campbell.	Mr. Campbell in 1856.
Grains.		Grains.
3.1	......Carbonate of Lime......	3.1
14.6	......Carbonate of Soda	59.9
19.6	.... Sulphate of Soda	
25.7	......Chloride of Soda	
2.4	...Carbonate of Magnesia ...	2.4
0.7	.... Silica	
66.1	...Total solid contents per gal....	65.4
	Silica, omitted by Campbell...	0.7
		66.1

I have compared the other two analyses of Mr. Brande, and I find they agree with those published by me in 1856, and I cannot find any discrepancy.

The three analyses in the third compartment are those made by Mr. Phillips, by order of the Directors of the North Western Railway, in 1849, and submitted to the Institution of Civil Engineers by one of the officers of that Company, I think Mr. Dockray. The object of that paper was to induce an explanation of the singular phenomenon that of three analyses of chalk water (Watford, Tring, and Camden-town), two (Watford and Tring) should hold 19.54 grains and 14.72 grains respectively of carbonate of lime, and only 1.98 grains and 1.38 grains of soda salts to the gallon, while in the third (Camden-town) no carbonate of lime could be found, but 41.70 grains of soda salts to the gallon.

Referring to the paper so presented, I find I have correctly given the analysis as therein submitted, and which is as follows:—

As presented to the Institution of Civil Engineers.			Analyses of three Chalk Waters, by Professor Phillips.	As presented by Mr. Braithwaite to Society of Arts.		
Camden Town.	Watford.	Tring.		Camden Town.	Watford.	Tring.
Grains	Grains	Grains		Grains	Grains	Grains
nil.	19.54	14.72	... Carbonate of Lime ...	nil.	19.54	14.72
17.60	„	„	... Carbonate of Soda ...	17.60	„	„
13.00	„	„	......Sulphate of Soda......	13.00	„	„
	0.94	1.09	......Sulphate of Lime......		0.94	1.09
11.10	1.90	1.38	... Chloride of Sodium ...	11.10	1.90	1.38
2.30	1.32	1.61	...Carbonaceous Matter...	2.30	1.32	1.61
44.00	23.70	18.80	.... Total	44.00	23.70	18.80

The fourth compartment of the Table is of three analyses of pump spring waters; that of the Treasury pump was taken from the published analyses of Dr. Bostock; the two from the wells at Roehampton were made for me by Mr. Beale, of Long Acre, in 1841, and were published by me six years ago, and for the purpose before stated. I cannot trace any inaccuracy in these hard—very hard-waters, there being in the Treasury pump-water 50.4 grains, in the Roehampton pump 88· grains, and 48 grains of *Salts of Lime* to the gallon.

The fifth and last compartment of the table consists of—1st, the analysis of Mr. Dugald Campbell; 2nd, the statement by Dr. Clark of the solid contents of a gallon; and the 3rd, the analysis of the College of Chemistry, all on and concerning the Trafalgar-square well water.

1st, As to Mr. Dugald Campbell and his analysis, I wish to invite particular attention.

At a discussion on a paper, prepared by me, of this very water question, for the Institution of Civil Engineers, in the session of 1855, Mr. Dugald Campbell differed then, as he now does, with me, in opinion, particularly as to his then omission of the 13.67 grains of sulphate of *potash* to the gallon, in the analysis of the College of Chemistry (Messrs. Abel and Rowney) of the Trafalgar-square well water. Being very desirous of a friendly explanation, I wrote courteously to Mr. Dugald Campbell, to inquire why he had omitted these potash salts, to which I received as courteous a reply, in which he observed—"I do not think it would benefit either of us entering into a correspondence which would likely be very lengthy, on the subject of your paper." I now very much regret that Mr. Campbell declined to meet me, because it is more than probable that, by mutual and friendly explanation, we should have avoided the present complications.

To proceed with Mr. Campbell's analysis. In April last, I was favoured by that gentleman with a report of his paper to the Chemical Society "On the Source of the Deep Wells under London," in which he gives a recent analysis of the Trafalgar-square well, made by him. I now place it in juxtaposition with the analysis in my table:

Statement in Mr. Campbell's printed Report.	D. Campbell's Analysis of the Trafalgar Square well water.	Statement in Mr. Braithwaite's Table.
Grains.		Grains.
10.58	...... Carbonate of Soda	10.58
21.34	...... Sulphate of Soda	21.34
19.04	...... Chloride of Sodium	19.04
1.05	......Carbonate of Potash	1.05
2.07	... Carbonate of Magnesia ...	2.07
2.74	...... Carbonate of Lime	2.74
0.97	...Phosphate of Iron & Lime...	0.97
0.40	.... Silica	0.40
0.66	...... Volatilized Matter	0.66
58.85	.... Total	58.85

One more reference to Mr. Dugald Campbell's letter and report. In the concluding part of *this letter*, Mr. Campbell invites me to an analysis of the several waters, observing, "I am sure that if Mr. Braithwaite would experiment himself, instead of culling portions of analyses here and there, and speculating upon them when reduced to a tabulated form, without *any data* of how they are obtained, he himself would neither differ so widely from chemists as he now does, nor would he find chemists to differ as widely from themselves as he states."

In Mr. Dugald Campbell's published report of his paper to the Chemical Society, 1856, page 3, commencing line 15, will be found the following, as a specimen of the *entente cordiale*. He modestly commences:—"Perhaps I may be allowed a digression here to state, that before this I had analysed the water from many of the deep wells in different parts of London, and in *all* I found a *large* amount of *soda salts*, and a *small*, though weighable quantity, of *potash salts*, varying in potash (carbonate) from 0·327 grains in a gallon to *as much* as 1·33 grains, but *I was scarcely prepared* to find the Trafalgar-square water to have the same character, Messrs. Abel and Rowney (College of Chemistry) having found 13·67 grains of *sulphate of potash* to the gallon. However, on procuring a copy of the Minutes of Proceedings of the Civil Engineers, vol. ix., I, *for the first time*, saw Mr. Brunel's analysis, and either he had not detected *any* potash salts in the water, or they were in such small quantities as not to be considered by him worth noticing, for they are not given in the analysis."

And now as to Dr. Clark's statement of the quantity of solid contents in one gallon of the Trafalgar-square water, namely, 79½ grains.

In January, 1855, I was invited to take part in the discussion on Mr. Homersham's paper, "On the Chalk Strata Considered as a Source for the Supply of Water to the Metropolis." I was not aware that Dr. Clark was in the room. In the observations I then made, more in reference to quantity than quality, I incidentally mentioned the large quantity of *sea salts* in the deep well waters. The Rev. Mr. Clutterbuck followed me, when Dr. Clark took both the Rev. Mr. Clutterbuck and myself very roundly, and, as I thought, not very courteously, to task; I presume for daring, as non-professionals, to offer any opinions as to the chemical condition of deep well waters.

Dr. Clark, in contradiction to me, stated, "that he had a friend sitting near him who told him that he had *accurately* examined these waters, and he said it was no such hing, and moreover, that a very small portion of salt was resent."

In answer to Dr. Clark and Mr. Homersham, I preared a paper, "On the Infiltration of Sea Water to the Wells under London and Liverpool." This paper was iscussed for two evenings at the Institution of Civil Enineers, and for which I was honoured with a Council remium—"Brande's Manual of Chemistry."

At the discussion, Mr. Dugald Campbell and Mr. Homersham were present, and took part.

On the second evening I produced the printed report, by Mr. Homersham, addressed to the Directors of the London (Watford) Spring Water Company, dated January 8th, 1850, *five years* prior to that gentleman's paper to the Society of Arts.

In that report I had found, in Appendix 1, page 43 to 46, a letter addressed to Mr. Homersham by Dr. Clark, of Marischal College, December 26th, 1849. I placed the report in the hands of Mr. Homersham, with a request that he would read to the meeting that part of the letter bearing on the chemical condition of the well water of Trafalgar-square. He did so as follows:—Page 45, line 16, "I say that the saline matter in the Watford spring water is of the same kind as the river water contains, meaning that it is of a very different kind from what is found in the deep spring waters below the London clay, commonly (however erroneously) called Artesian well waters, respecting which, as the only considerable source of supply of another quality of water within reach of London, I will take a brief notice.

"In the deep spring waters alluded to, there is a large quantity of *bicarbonate of soda*, 28¼ grains per gallon, according to the recent analysis in the Royal College of Chemistry, upon the water at Trafalgar-square.

"There are other 51.3 grains of saline matter present, say 79½ grains in a gallon in all. When boiled, this bicarbonate of soda is reduced to the carbonate of soda, and its alkaline taste may then be easily recognised in the water. A solution of carbonate or bicarbonate of water of this strength will act medicinally on the kidneys.

"By calculation from the analysis alluded to the hardness of the Artesian water is 5.9 grains, which nearly agrees with *my own experiments in this* and other deep waters in London; 100 gallons of *it* would form a lather with 13oz. of curd soap."

(Signed) "THOMAS CLARK."

I introduced this letter to show that Dr. Clark's friend could not have accurately examined this water, and that the Doctor must have forgotten what he had written in 1849, when he spoke on the subject at the Society of Arts in January 1855.

In the table I submitted, under the head Campbell and Clark, the accidental omission of a bracket has led to the erroneous impression that I attributed the other 51.3 grains of saline salts mentioned in Dr. Clark's letter to the sulphate of magnesia; a glance at the table will show the figure 51.3 midway, and it is only necessary to introduce the bracket to the printed table and the omission will be remedied; however, I apologise for the accident, the more so as it seems to have put Mr. Campbell sadly out of the way.

It only remains for me to explain the analysis of the College of Chemistry, which I have shown in the table to contain 67.2798 grains to the gallon of the Trafalgar-square well water. I find I have omitted ammonia apocrenic acid, and I think some other traces, but, to be hypercritically correct, I ought to have stated the solid contents at 69.9449228 to the gallon.

With your permission I shall resume this communication to you in your next number, but before closing this, I trust I have thus far temperately, but satisfactorily, disproved Mr. Dugald Campbell's assertion that nearly all the examples I adduced had been subjected to mutilation or change, his own among the number, and that in stating the solid contents in one gallon of Trafalgar-square so-called chalk water to be—

By Mr. Brande	66.1	grains to the gallon.
By Dr. Clark	79.8	do.
By Mr. D. Campbell	58.85	do.
By College of Chemistry...	69.9449228	do.

I have ample authority for so doing.

I remain, sir, your very obedient servant.

FREDERICK BRAITHWAITE.

32, Gower-street, Bedford-square, May 26,1856.

TRAFALGAR SQUARE WATER.

Sir,—In page 435 of your *Journal*, Mr. Frederick Braithwaite gives, as the result of *Dr. Clark's* analysis of a gallon of the Trafalgar-square water,

Bicarbonate of Soda..............	28.5	grains
Sulphate of Magnesia	51.3	„
Total..............	79.8	grains

The only authority Mr. Frederick Braithwaite can have for the above statement of his is the following passage in a report of Dr. Clark's to me, dated Marischal College, Dec. 26, 1849, on the subject of the Watford spring-water in reference to his softening process, and published by me at the time in an appendix to a Report to the London (Watford) Spring-water Company:—

"In the deep spring-waters alluded to, there is a large quantity of bicarbonate of soda; 28¼ grains per gallon, *according to the recent analysis in the Royal College of Chemistry, upon the water at Trafalgar-square.* There are also *other* 51.3 *grains of saline matter* present; say 79½ grains per gallon in all."

You will observe that Dr. Clark does not here profess to give the results of an analysis of his own, but merely the results of simple calculations made by him from a then recent analysis that had been made in the Royal College of Chemistry. You will observe, too, that what Dr. Clark gives as 51.3 grains of *other saline matter* than bicarbonate of soda, Mr. Braithwaite tabulates as *sulphate of magnesia.*

The quantitative result as to carbonate of soda in the Royal College of Chemistry is given as 18 grains of carbonate of soda per gallon, according to the usual practice of chemists, although the soda is, in the water, really in the state of bicarbonate of soda, the well-known crystals, which would weigh 28¼ grains, as Dr. Clark states. In short, Dr. Clark merely makes a few very simple calculations from the results of the analysis of the Royal College of Chemistry; yet, knowing this perfectly, Mr. Braithwaite, as if there had been a really different experimental result, signalises, among others, the names of Dr. Clark and the Royal College of Chemistry as chemical authorities, "*in each of whose analyses there was a very wide difference as to the chemical composition of the water.* It is therefore, (continues he) only fair to ask for some explanation on this subject."

Mr. Frederick Braithwaite's representations have made this explanation necessary to your readers, however superfluous it must be to himself.

I may mention, that the softened Watford water would be only half the hardness of the Trafalgar-square water, and would contain only an eighth of its saline contents.

I am, yours obediently,
SAMUEL COLLETT HOMERSHAM.

19, Buckingham-street, Adelphi,
May 28th, 1856.

P.S.—Dr. Clark, in his report to me of the 26 Dec., 1849, before alluded to, states that he had himself experimented on the "hardness" of the "Artesian" and other deep waters in London, but no where states that he had analyzed it.

THE OIL OF THE AVOCADO PEAR TREE.

Department of Science and Art, 8th May, 1856.

Sir,—I am directed by the Lords of the Committee of Privy Council for Trade to enclose for the information of your Society a copy of a letter from the Governor of Trinidad, in regard to the useful application of the oleaginous fruit of the Avocado pear-tree (*Laurus Persea*), and I am to request that you would kindly take such steps as you may deem desirable to bring it under the attention of manufacturers interested in the employment of fatty bodies.

I have the honour to be, Sir, your obedient servant,
LYON PLAYFAIR.

The Secretary, Society of Arts.

(Copy.)

Trinidad, 22nd February, 1856.

Sir,—In my long tropical service it had been a frequent source of surprise to me that no attempt had been made, at least to my knowledge, to ascertain whether the highly oleaginous fruit of the Avocado pear tree (the *Laurus Persea*) would not produce an oil suitable for culinary or illumination purposes, or for any of the other important uses to which vegetable oils are subservient, as the manufacture of soap, the lubrication of machinery, &c., &c. Shortly after my arrival here, pursuing this idea, I requested Mr. Herman Cruger, a German gentleman, of great intelligence, following the business of a chemist and druggist, in Port of Spain, to extract the oil from 100lbs. of the pulp of this fruit, and to experimentalise, with such conveniences as he had at hand, on its constituents and probable uses.

The results of Mr. Cruger's well conducted investigations, seemed to me to be so interesting, both on the material point of the proportion of oil to the bulk of pulp, and its excellent properties as an illuminant, that I deemed it right to transmit a few bottles, accompanied by his careful report, to Dr. Hofmann, Professor of the Royal College of Chemistry in London, who, I believe, stands at the head of his profession in the chemistry of vegetable substances.

By the last mail from England, the Professor had the goodness to forward to me the accompanying report, with specimens of the oleine, stearine, and soap which he had succeeded in producing from the Avocado pear oil I had sent to him. You will perceive with satisfaction that Professor Hofmann considers that this oil will prove to be a valuable addition to the oils used for illumination and in the manufacture of soap. He estimates the Avocado pear oil to be little inferior to sperm as an illuminant, and equal to palm oil for soap. I may mention on this last subject that the Indian women on the Main are said to use the fruit in the raw state with remarkable effect in the cleansing and strengthening of the hair, and the small specimens of soap produced from this oil, sent out by Professor Hofmann, strengthens my own impression that it will be found to have peculiarly softening effects on the skin. It will be noticed that the Professor does not consider it well settled yet, that the oil may not be purged of a certain acridity of taste (to which I incline to ascribe its detergent and softening effect on the skin and hair), but if that should prove practicable on experiments on larger quantities than he has hitherto treated, he thinks it might be extensively used for the same purposes as olive oil.

I have referred Professor Hofmann's Report to a Committee of our corresponding Society of Arts and Sciences, with the view to make it public in the Colony, and to collect detailed information from experienced persons respecting the best management of the tree, average weight of produce, &c. For the present, therefore, I shall merely say, that the "Laurus Persea" exists in large quantities in the Island, and that vast amounts of fruit are utterly wasted every year in the more remote districts. It bears fruit during about three months of the year, may be grown in any soil in these climates in protected situations from high winds (infrequent at Trinidad), needs no sort of cultivation, begins to bear at four or five years' growth, and produces as the tree becomes mature a prodigious weight of fruit. It should also be mentioned that some qualities are more oleaginous than others. The per centage of oil, according to Mr. Cruger's experiments, with imperfect means of expression, was between 12 and 13 per cent. to bulk of pulp, which, I believe, is heavier than the olive. I was informed by Mr. Purdie, the superintendent of our Botanical Garden, that 200 full-grown trees would be about the proportion—per acre, in systematically laid out plantations. I regret that I did not send some of the stones of the fruit to Professor Hofmann, for it produces a deep and indelible black stain, and might turn out to be useful in the manufacture of ink, and perhaps for other purposes.

I caused this oil to be exhibited at our annual exhibition of 1855, and the Committee of Management were pleased to award me a gold medal, but I requested them to present it to Mr. Cruger, who had, with much care and skill, established the usefulness of what was no more than a conception on my part.

May I hope you will authorise me to convey to this modest and truly useful member of this community, your approbation of the public spirited readiness he has always displayed in seconding efforts for ascertaining and developing the various and too neglected resources of this remarkable island. Such dispositions are well worthy of encouragement here and throughout the West Indies.

I have, &c.,
(Signed) CHARLES ELLIOT.

(Copy.)

Corresponding Committee of the Society of Arts,
Government House, 15th February, 1856.

The accompanying letter to his Excellency the Governor, and preliminary report on the application of the oil of the Avocado pear, by Dr. Hofmann, Professor of the Royal College of Chemistry of London, are published for general information.

It may be necessary to state that the authority of Professor Hofmann on all questions of the chemistry of oleaginous or fatty substances, is second to none in England, or probably in Europe.

The wardens of the several unions or parties interested in the cocoa cultivation of the Colony, are requested to forward any information which they may procure connected with the produce of the Avocado pear tree, or with the matters treated of in Professor Hofmann's report to A. W. Anderson, H. Cruger, and William Purdie, Esquires, a Committee of the Corresponding Committee of the Society of Arts.

By order of the Corresponding Committee
of the Society of Arts,
(Signed) SYL. DEVENISH,
Secretary, *pro tem.*

(Copy,)

Royal College of Chemistry, January 4, 1856.

Sir,—In reply to your letter dated 6th January, 1855, and which I received about a month later, I beg to forward you a preliminary report upon the oil which you submitted to me for examination, together with some specimens which were obtained from the oil in question.

This oil I received at about the same time, together with the lucid remarks of Mr. Herman Cruger, who extracted the oil from the Avocado pear.

I have to apologise for sending this report so late, but many previous engagements, and especially my co-operation as Juror at the Exhibition in Paris, which kept me away from London during a considerable part of the summer, prevented me from directing my attention to this examination at an earlier period. I hope, however, that the satisfactory nature of this preliminary report will, in some measure, compensate for the delay.

I have, &c.,
(Signed) A. W. HOFMANN.
His Excellency Governor Elliot.

(Copy.)

Preliminary Report on the Application of the Oil of the Avocado Pear.

The oil, when arriving in this country exhibited a dark greenish brown colour, it was rather viscid, and small particles of a solid fat were disseminated through the liquid It exhibited to a remarkable degree the peculiar acrid taste which is mentioned in the statement accompanying the specimen.

The chief questions to which my attention was directed were the following:—

1. How can the oil be divested of its bitter taste, so that it might be used as an article of food.
2. What is the value of the oil for illuminating purposes, and can the solid fat be extracted with advantage.
3. What is its value as a lubricating material.
4. Is the oil applicable for the manufacture of soap.

With regard to the first point, I may state at once, that all my attempts to purify the oil from the acrid principle which renders its taste bitter and unpleasant have failed. The several specimens of the solid and liquid portions of the oil which I have prepared, all retain more or less this unpleasant bitterness, nor do I at this moment know exactly the substance which produces this disagreeable flavour. But, although the experiments hitherto tried have not been successful, it is by no means impossible that a further prosecution of this inquiry may lead to very different results, especially if a more copious supply of the material should enable us to operate upon a larger scale. When separated from the acrid source of this taste and from a small amount of mucilaginous matter, (the elimination of which presents no difficulty) this oil might be used as a substitute for olive oil in the preparation of food.

In testing the applicability of the oil for the purposes mentioned under the second head, the results obtained were more satisfactory. In fact when submitted to a very simple process of purification somewhat similar to that which is used in France for the refinement of rape oil, (and which essentially consists in treating the oil with a small quantity of sulphuric acid for the purpose of destroying the mucilaginous principles) this oil becomes a substance extremely valuable as an illuminating material. It may be used for burning in lamps with considerable advantage; in fact, the illuminating power of the oil is not very much inferior to that of the average quality of sperm oil. I believe that burning in lamps will be one of the principal applications which the oil will receive, when it is prepared on a more extensive scale, and delivered in a larger quantity in the markets. I may state that several practical men to whom I have shown the oil in the crude and in the refined condition, concur with me in this opinion. My friend Mr. George Wilson, the managing director of that colossal establishment, "Price's Patent Candle Company," who, from his particular experience and from his numerous researches and investigations connected with the manufacture of fatty bodies, must be considered as one of the best authorities upon this subject; Mr. George Wilson, who has kindly assisted me in these experiments, after having become acquainted with the oil, immediately offered to take fifty tons, or any fraction of fifty tons of the oil, at the price of £30 per ton, delivered in London, for the purpose of carrying out the inquiry suggested by your Excellency on a scale commensurate with the importance of the subject.

I have also endeavoured to separate the solid fat, the stearine from the oil of the Avocado pear, as far as this is possible by processes which are applicable upon a large scale. The amount of solid fat is far inferior to that which I was led to expect at the first glance, the viscidity of the original oil being greatly due to the presence of mucilaginous matters. I have the honour of transmitting, together with this report, specimens of the liquid and of the solid portions of the oil. Your Excellency will remark that, though these specimens are not absolutely colourless, their colour has been greatly diminished by the simple process of refining with sulphuric acid.

According to my present experience, the oil of the Avocado pear is less valuable as a lubricating material. To make it fit for the higher classes of machinery, its mucilaginous constituents must be removed by the same refining process requisite for its adaptation in illuminating purposes. This will slightly increase its price. Even when purified it retains an attraction for oxygen, by which it becomes rapidly coloured, viscid, and actually acid. It cannot, either in price or in applicability, compete with that remarkable substance "Paraffin Oil," which has been discovered within the last year by Mr. James Young, and which is now manufactured by him on a large scale, by the distillation at a low temperature of several varieties of coal.

On the other hand, the oil of the Avocado pear is very well applicable for the production of good soap. I have the honour of transmitting to your Excellency specimens prepared with the oil; the smaller one, which possesses a yellow colour, is prepared with the oil in its original condition; the larger one is made with a portion of oil which had previously been bleached by chlorine. From this specimen it is obvious that the oil, although poor in stearine, nevertheless, furnishes a soap which is tolerably hard and solid. It ought to be remembered that it is difficult to obtain a hard soap by working on the small scale prescribed by the limited amount of material at my disposal. For the more perfect elaboration of this investigation also, a large supply of material will be of great advantage; but I have even now no hesitation in stating, that for the purposes of the soapmaker, the oil of the Avocado pear will have at least the same value as palm oil.

From the above statements your Excellency will perceive that the oil of the Avocado pear is a substance of considerable commercial value; that it is very probable that this value will be greatly increased if the command of a larger quantity should enable practical men to carry out experiments on a larger scale, and one far more likely to procure the oil in a state of greater purity than could be accomplished by small laboratory trials.

I would, therefore, suggest that your Excellency should direct that measures be immediately taken for producing and transmitting to this country a larger supply of oil. The experience and the manipulatory dexterity of Mr. H. Cruger will, no doubt, afford great assistance in effecting this object.

The oil of the Avocado pear can be obtained with great facility. The applications of which it is capable are valuable and numerous. The substitution of the *Laurus Persea* for the useless *Erythrina Umbrosa*, under the shadow of which the cocoa tree is now growing, must be highly advantageous to the cultivation of that useful plant.

All these things being considered, the idea of promoting the growth of the *Persea* appears to me a most happy conception, and when carried out with vigour and circumspection cannot fail to confer lasting benefits on the Colony.

I have, &c.,

(Signed) A. W. HOFMANN, F.R.S.

Proceedings of Institutions.

Annan.—The eighth annual report states that the number of life members is now 19; that of honorary members has averaged during the year, 30; ordinary, 139; lady, 10; and apprentices, 18. These, compared with last year's returns, show a small decrease in honorary and apprentice members, an increase of life members, and about an equal number of ordinary and lady members. It states that the library now contains upwards of 1,400 volumes, and that there is a prospect of its being considerably augmented in a short time. It has been increased during the current year by about 150 volumes, all of which, with the exception of 21 volumes of a Statistical Account of Scotland, presented by Mr. C. Dall, factory-manager, Annan, and about ten volumes presented by friends, have been purchased with the funds of the Institute. The issue of books was about 200 volumes weekly during the winter quarters. The news-room in the Town-hall continues to be supplied with upwards of 30 of the leading metropolitan, provincial, and local newspapers, and *Blackwood* and *Tait's Magazines*. During the winter twelve lectures were delivered in connection with the Institute, and an entertainment was given by Mr. Hart, of Ulverstone, to a large audience, the proceeds of which, amounting to £8 17s., were presented to the Institute. During part of the year a Literary and Discussion Class was kept up with spirit. A variety of articles of curiosity have been added to the Museum.

Dawlish.—The sixth annual *soirée* of the Literary Society was held at the Assembly-rooms, on Thursday, the 7th ult. Tea was provided at seven o'clock, of which about 100 of the members and their friends partook. After tea, C. J. Plumptre, Esq., barrister-at-law, President of the Society, delivered an address, in which, referring to the title of the Society, he said—in an agricultural parish like Dawlish it would have been a misnomer to have called it a Mechanics' Institute; and they could not have been expected, for one moment, to compete with the great Mechanics' Institutes of Liverpool, Manchester, and other large manufacturing towns. He did not think that such Societies as that whose anniversary they were met to celebrate could be considered as educational *substitutes* in any way; but he believed they could be made the means of affording, by useful and entertaining lectures, much valuable information to those whose time and toil prevent them devoting the time that they could wish to literary pursuits; that they might be made the vehicles for presenting many materials for thought and subsequent reflection; the common meeting-ground of various classes, and the mart for exchanging kindly feelings and mutual sympathies; and also the means of affording innocent and agreeable relaxation—a stimulus to higher and purer sources of pleasure than those afforded by low and sensual gratifications, and an introduction to a wide and boundless field of enjoyment. Mr. D. Babbington Rind and Mr. P. J. Margary having addressed the meeting, a concert of vocal and instrumental music followed, the proceedings terminating with a ball.

Huddersfield.—The announcement of the prizes for 1856, in connection with the Mechanics' Institute, has just been made. It is an important one, embracing the distribution of Prince Albert's present of twenty-five guineas, and a donation of six pounds from the Dean of Hereford. The first prize is one of three guineas for an original design, a second prize of two guineas being also given. Two guineas will be awarded for the best original essay, with a second, of one guinea, for the next in excellence. The rest of the sum given by the Prince is divided into guinea and half-guinea prizes, for the twenty-eight advanced classes, which are grouped to facilitate the division, or as first prizes for some of the more numerous of the forty-eight elementary classes. Subordinate prizes, of less value, will also be given in the junior sections. The Dean's gift is, at his request, to be awarded in three prizes, for the best examinations in the respective studies of geometry, physical geography, and English history from the accession of Henry VII. to that of Charles I. The p programme also contains a valuable award in the no nation to a situation in the civil service, offered, as annual prize, by Mr. John Wood, the Chairman of th Board of Inland Revenue, through the kind interventi of the Dean of Hereford.

Royston.—The exhibition in connection with the M chanics' Institute has now been closed. It was open twenty-two times during the fortnight, and was visited nearly 6,940 persons. The average number present each day was 578, and the greatest number present o single day was 1,657. It was opened twice specially mechanics and domestic servants, and twice for Nation British, and Sunday Schools. The proceeds amounted £327 14s. 8d. up to the close of the Exhibition, which time there have been further receipts, and th is a prospect of additional funds arising from the sale articles presented to the Institute, and at present rema ing unsold. A large sum will, of course, have to be ducted from this amount for the expenses of the Exhi tion; but there will remain a handsome balance in liqui tion of the building debt. On Wednesday evening, 28th instant, a promenade concert was given in the L ture-hall. The principal feature of the evening was the presentation of a testimonal clock to the Honorary Secretary, Mr. John Warren. On its face was inscribed:—"Presented by the Members of the Royston Institute to John Warren, to mark their sense of his able and zealous services as Honorary Secretary, May 12, 1856."

Miscellanea.

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Decimal Coinage.—The state of the Decimal Coinage question is now as follows:—After the strong recommendation of one particular plan by two scientific Commissioners, by a Committee of the House of Commons, and by a vote of the House itself, followed by the organisation of an association containing hundreds of parliamentary and hundreds of commercial names, and supported by the Bank of England,—Lord Palmerston appointed a Royal Commission, consisting of Lord Monteagle, Lord Overstone, and Mr. Hubbard, to consider the whole question. This Commission has now been at work some months; but none of its proceedings have been published. The plan so strongly supported is, as our readers know, that the present pound should be retained, but made to consist of 1,000 new farthings, or *mils.*, instead of 196 of the present farthings. This plan retains the florin (100 mils), the shilling (50 mils), the half shilling (25 mils). It also retains the copper coins, lowering their value 4 per cent., so that the *sixpence* (as it will still probably be called) is 25 mils instead of 24 farthings. A new coin of 10 mils, the *cent*, very like 2½d. of the present money, completes the system. It is strongly contended that no change so simple as this is to be found among all the schemes which have been proposed. On the other hand, a strenuous few, but with very little support, have contended for systems which throw out the sovereign and the shilling, building up from the penny in one proposal, from the farthing in another. Surely it would be easier to keep the existing pound, the existing florin, shilling, and half-shilling all unaltered, and the minor coins at 4 per cent. less value, than to learn a new system in which the coins are ½d., 2½d., 2s. 1., and £1 10d.; or else one in which the new coins are $\frac{1}{10}$d., 1d., 10d., and 8s. 4d. of our present money. The genius of English reform is to alter as little as possible, and to keep as much of the old way as possible. A re-fabrication of all the silver *coinage* is a thing which will never be done, except under the most urgent necessity. The shillings in circulation, piled one upon another, would make a *rouleau* eighty miles high. The most prominent advocates of the farthing and penny schemes recognise the difficulty of recoinage, and propose that the new coins shall be gradually introduced, and the old ones gradually withdrawn. Thus, for a long period, we should have two different systems of payment, under what is presumed would be one system of reckoning, the new decimal system.—*Athenæum.*

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 24th and 26th May, 1856.

Par. No.
137. Bills—Poor Law Amendment (Scotland).
138. Bills—Sir William Fenwick Williams' Annuity.
139. Bills—Annuities (No. 2).
140. Bills—Reformatory and Industrial Schools (as amended in Committee, and on Re-commitment).
141. Bills—Public Health Supplemental Bill.
144. Bills—Oath of Abjuration (Amended).
147. Bills—Grand Jury Assessments (Ireland) (Amended).
148. Bills—West India Loans (Amended).
Poor Law Board—8th Annual Report.
Loan Fund Board of Ireland—18th Report.
Census of Ireland for the year 1851—Part 5 (Tables of Deaths), Vol. 2.

Delivered on 27th May, 1856.

39 (4) Trade and Navigation Accounts (30th April, 1856).
231. Public Health Act—Return.
232. River Weaver (Account).
142. Bills—Small Debts Imprisonment Act Amendment (Scotland).
149. Bills—Lunatic Asylums (Ireland) (No. 2).

Delivered on 28th and 30th May, 1856.

177. Charities—Return.
232. Suspended Canonries—Return.
41. Local Acts (29, Isle of Wight Steam Bridge and Approaches (Supplementary Report); 30, Sittingbourne and Sheerness Railway)—Admiralty Reports.
134. (1) Sherburn Hospital—Copy of a Letter.
208. Factories—Returns.
222. Public House Licenses—Returns.
234. Sligo Election—Minutes of Evidence.
236. Spirits (Ireland)—Returns.
237. Metropolis Roads—Return.
240. Insolvent Debtors' and Bankruptcy Courts (Ireland)—Return.
243. Coalwhippers (Port of London)—Returns.
174. Ecclesiastical Commission—Appendix to First Report.
107. Bills—Dublin Metropolitan Police.
135. Bills—Judges and Chancellors.
145. Bills—Police (Counties and Boroughs) (as amended in Committee, on Re-commitment, and on Consideration of Bill, as amended).
153. Bills—Reformatory and Industrial Schools (as amended in Committee, on Re-commitment, and on Second Re-commitment.
154. Bills—Public Health Act Amendment.
155. Bills—Burial Acts Amendment.
152. Bills—Joint Stock Companies (as amended in Committee, on Re-commitment, and on Second Re-commitment).
151. Bills—Gaols, &c.
150. Bills—Dublin University.
Emigration—16th Report of the Commissioners.
Inspectors of Factories—Reports (30th April, 1856).

Delivered on 31st May and 2nd June, 1856.

199. Superannuations—Return.
209. Sugar, &c.—Return.
221. (1) Public Libraries (Ennis, Cork, and Limerick)—Return.
241. Plumstead Parish (Want of Accommodation for Divine Worship)—Copy of Memorial.
216. Statute Law Commission—Return.
230. Church Affairs (Jamaica)—Copies of Correspondence.
143. Bills—Nuisances Removal, &c. (Scotland) (No. 2.)
156. Bills—Smoke Nuisance Abatement (Metropolis) Act, 1853, Amendment.
157. Bills—Excise.

Delivered on 3rd June, 1856.

246. Preston Union (Lancaster)—Correspondence, &c.
146. Bill—Poor Law Amendment (No. 2).
Charitable Donations and Bequests (Ireland)—11th Annual Report.

Delivered on 4th June, 1856.

90 (7). Civil Services Estimates—Class 7 (a corrected leaf).
239. King's College, Aberdeen—Return.
158. Bill—Registration of Voters (Scotland) (as amended by the Select Committee.)

MEETINGS FOR THE ENSUING WEEK.

Mon. Geographical, 8½, 1. Renewed discussion on Capt. Stokes' paper "On Steam Communication with Australia and the Cape of Good Hope." 2. "Mr. Lionel Gisborne, "Isthmus of Darien—Investigations connected with the Search for the Best Locality to make an Inter-Oceanic Canal." 3. Admiral Illingworth, "Note on the Isthmus of Cupica." 4. Mr. W. D. Cooley, "Journey of Joachim Rodrigues Graça to the Muata ya Nu, Central Africa."
Tues. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Syro-Egyptian, 7½, Mr. Mackenzie, "On the Inscriptions on the Temple of Edfou, and the Egyptian Names of Planets."
Medical and Chirurgical, 8½.
Zoological, 9.
Wed. Literary Fund, 3.
Royal Society, Literature, 4½.
Society of Arts, 8, *Extra*, Mr. Humphrey Chamberlain, "The Drying and Burning of Bricks."
Ethnological, 8½.
Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Antiquaries, 8.
Royal, 8½.
Fri. Astronomical, 8.
Philological, 8.
Royal Inst., 8½, Prof. Faraday, "On some Points in the Molecular Philosophy of Gold and Silver; M. Petitjean's Silvering Process."
Sat. Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May 30th*, 1856.]

Dated 7th April, 1856.

836. John Gedge, 4, Wellington-street South, Strand—Improvements in tiles for buildings. (A communication.)

Dated 6*th May*, 1856.

1062. Obed Blake, Thames Plate Glass Works, Blackwall—Improvements in applying practically the principle of internal reflection within transparent substances.

1064. William Joseph Curtis, 1, Sebbon street, Islington—Improvements in constructing the permanent ways of railways.

1066. William Edward Newton, 66, Chancery-lane—Improved machinery for making envelopes. (A communication.)

1068. Richard Archibald Brooman, 166, Fleet-street—A method of treating guano and other matters containing uric acid and the manufacture from the products arising from such treatment as well as from uric acid, of new colouring matters, and the fixing and application thereof. (A communication.)

Dated 13*th May*, 1856.

1122. Michael Hodge Simpson, Massachusetts, U.S.—Improvements in machinery for combing wool or various other fibrous substances.

1124. Hiram Tucker, Massachusetts, U.S.—Improved spring sacking or foundation for a bed mattress, or other like article.

1126. Charles Boosey, 24, Holles-street, Cavendish-square—Improvements in music stands for the use of military and other bands. (A communication.)

1128. William Edward Newton, 66, Chancery-lane—Improved apparatus for generating illuminating gases from coal or other substances. (A communication.)

1130. William Edward Newton, 66, Chancery-lane—The novel application of certain substances to be employed in printing upon woven or other fabrics, and paper. (A communication.)

Dated 14*th May*, 1856.

1132. William Galloway and John Galloway, Manchester—Improvements in machinery for rasping, cutting, and chipping dye woods.

1134. Joseph Hadley Riddell, 5, Sherborne-lane, City—Improvements in stoves or fire places.

1136. Jerome André Drieu, Patricroft, near Manchester—Improvements in weaving horse cloths, blankets, rugs, or similar thick materials.

1138. Uriah Scott, Camden-town—Improvements in public carriages, and various parts of the same, which parts may be used separately, and applied to vehicles of any description.

1142. Charles Gibson, Draycott, Derby—Improved machinery for the manufacture of bricks, tiles, pipes, and other articles made of clay or plastic materials.

1144. William Horatio Harfield, 113, Fenchurch-street—Improvements in machinery for cutting and smoothing the surfaces of metallic nuts. (A communication.)

Dated 15*th May*, 1856.

1146. John Cox, Ivy-bridge-cottage, near Caerleon, Monmouthshire—Improvements in coke and coke ovens.

1147. Robert Walker and Alexander McKenzie, Glasgow—Improvements in electric telegraphs.

1148. William Norris and Robert King, Liverpool—Improvements in anchors.

1150. James Leck and Alexander Miller, Glasgow—Improvements in singeing textile fabrics.

1152. Hugh Greaves, New Palace-yard—Improvements in the permanent way of railways.

1153. Charles Richard Williams, Shiffnal—Improved implement or apparatus for the cultivation of land.

1154. Richard Archibald Brooman, 166, Fleet-street—Improvement in stuffing seats, cushions, furniture, and other similar articles. (A communication.)

1155. Samuel Weston Moore, Nottingham—Improvements in dividing and finishing lace goods.

1156. William Marychurch and John Griffiths, Haverfordwest—Improvements in horse rakes, part of which is applicable to two-wheel carriages.

1157, Matthew Townsend, Leicester—Improvements in the manufacture of knitted fabrics.

1158. William Smith, 10, Salisbury-street, Adelphi—A new application of the syphon as an irrigator, and a motive power machine. (A communication.)

Dated 16*th May*, 1856.

1162. William Henderson, Dunkeld, Perthshire—Improvements in the manufacture of brooms.

1164. Andrew Barclay and John Wallace, Kilmarnock—Improvements in apparatus for the manufacture and measurement of illuminating gas.

Dated 17*th May*, 1856.

1166. Richard Coleman, Chelmsford—Improvements in implements for ploughing, hoeing, and scarifying land.

1168. Siegerich Christopher Kreeft, Fenchurch-street—Improvements in the manufacture of iron and steel. (A communication.)

1170. Gustav Sheurmann, 86, Newgate-street—Improvements in printing music.

1172. Johan Jacob Meyer, 28, Tatham-street, Molesworth-street, Rochdale—Improvements, in machinery for mortising, tenoning, rounding, sweep and straight moulding, boring, grooving, and mitreing.

1174. Charles Titterton, Roehampton—Improvements in the manufacture of zinc and zinc white.

1176. Richard McCloy and John Hare, Glasgow—Improvements in spinning and twisting fibrous materials, and in the machinery or apparatus employed therein.

1178. George Carter, Mottingham, Kent—Improvements in the mode of propelling and steering vessels, and in the apparatus and machinery applicable thereto.

Dated 19*th May*, 1856.

1180. Jeremiah Brown, Kingswinford—Improved machinery to be used in the manufacture of iron.

1182. George Clark, Great Cambridge-street, Hackney-road—Improvements in the manufacture of illuminating gas.

1184. John Kinnersley Smythies, 27, Kensington-park-gardens—Improvements in apparatus or instruments for ascertaining the points of the compass, and the latitude and longitude of a place.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 30*th*, 1856.

2730. John Marsh.
2731. Adam Bullough.
2740. Alfred Vincent Newton.
2742. Charles Hawker and Thomas Parry Hawker.
2741. William Mosley.
2766. John Allin Williams.
2786. Richard Archibald Brooman.
2811. Richard Holben.
2857. William Wilkinson.
2858. Jean Baptiste Emile Saffroy.
2805. Edward Tyer.
108. Joseph Hostage, Thomas Ives Brayne Hostage, and John Tatlock.
342. Charles Swan and George Frederick Swan.
558. Charles Morgan and Chas. Ranken Vickerman.
628. Joseph Dumas.
666. John Watson Burton and George Pye.
706. John Henry Johnson.
708. George Hallen Cottam and Henry Richard Cottam.
709. James Hargraves.
726. William Edward Newton.
751. Alfred Vincent Newton.
799. Henry George Hine.

Sealed June 3*rd*, 1856.

2732. John Moffat.
2733. William George Plunkett and John Bower.
2734. William Nunn.
2735. Thomas Mara Fell.
2737. Caesar Heilmann.
9754. Thomas Russell Crampton.
2755. Angier March Perkins.
2757. Angier March Perkins.
2762. James Gardner, Henry Gardner, and John Carey Gardner.
2764. Charles Lenny.
2768. Henry Bessemer.
2778. Andrew Maclure.
2782. Thomas Heppleston and John Hunter.
2794. Alexandre Tolhausen.
2804. Rogers Ruding.
2805. Robert W. Davis and Daniel Davis.
2810. William Leighton.
2859. Alexandre Tolhausen.
2876. Robert Walker.
2896. Henry Francis.
2898. William Joseph Curtis.
2902. John Henry Johnson.
2904. Christopher Dresser.
2906. Edward Rowcliffe.
2918. Alexandre Tolhausen.

Patents on which the Third Year's Stamp Duty has been Paid.

May 26*th*.

1310. William Henry Bentley.
1321. Edward Duclos de Boussois.
1662. Abraham Walter Craig, Daniel Foster, and Thomas Valentine.

May 27*th*.

1318. Daniel Bateman.

May 28*th*.

1347. Admiral the Earl of Dundonald.
1351. John Robert Johnson.
1360. William Edward Newton.
1369. James Hayes.
1420. Samuel Frankham.

May 30*th*.

1340. Edward Wilkins.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3837	May 15.	The New Union or Alliance Buckle	William Aston..........................	Birmingham.
3838	May 16.	Improved Spring-Fastening for securing the covers of small fancy and other boxes used for holding small wares, such as buttons, pens, hooks and eyes, &c., such articles as are usually made up and sold in boxes	William Aston..........................	Birmingham.
3839	May 19.	Improved Double or Single-Action Rotatory Carpenters' Brace Heads	W. Adsetts	Sheffield.
3840	May 21.	Dent's Perfected Collar	Dent, Allcroft, and Co.... ..	97, Wood-street, Cheapside.
3841	May 23.	The Derwas Curricle and Harness	Edwin Kesterton..................	Long-acre.
3842	May 26.	Improved Lever Cask Stand	Richard Waygood	Newington Causeway.
3843	May 26.	Improved Lock	Cope and Collinson	Birmingham.
3844	May 26.	Penholder	Joseph Gillott.....................	Birmingham.

Journal of the Society of Arts.

FRIDAY, JUNE 13, 1856.

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EXTRA-ORDINARY MEETING.

Wednesday, June 11, 1856.

An Extra-Ordinary Meeting was held on Wednesday, the 11th of June, Joseph Glynn, Esq., F.R.S., in the chair.

The following Institution has been taken into Union since the last announcement:—

417. Lockwood, Mechanics' Institution.

The paper read was—

ON THE DRYING AND BURNING OF BRICKS.

By Humphrey Chamberlain, Draining Engineer, Kempsey, near Worcester.

In the preceding paper I arrived at that stage of the manufacture in which machinery may be considered to have rendered us all the aid that we require of it, and left the plastic clay formed into bricks. In proceeding with the manufacture, we have next, by means of evaporation, to get rid of the water with which it was necessary to work the clay for the purpose of making it ductile. The oldest system is that of laying the bricks, as moulded, on floors or flats. These are spaces of ground worked very smooth, of a slightly convex form, from six to ten yards wide, and of any desired length. The bricks are exposed on these flats until they are stiff enough to bear being removed by hand; they are then walled or hacked on each side of the floors, from six to twelve high, one row on another, with a space of from half to three-fourths of an inch between each brick, to allow a current of air between them. They are then covered with roofing tiles, or tiles made on purpose, and, in some instances, with straw; then left until they are sufficiently dry for the last process,—burning. In some works the bricks are hacked as they are made, by the use of pallet-boards, and as explained in the making by the machine. This is the general system of the present day, and the reason why the manufacture is restricted to one season of the year. For during the winter, the late autumn, and the early spring, on account of the lower temperature of the atmosphere, shorter days, and absence of sun, the bricks would be a very long time in drying, and a frost would totally destroy all containing any moisture. In dull, damp seasons this process is very slow and tedious. The bricks are also much deteriorated in quality from the washing of the rains on the floors, or against the ends of them in the hacks. In such seasons, a brickmaker, in order to get over his usual amount of work, often requires double the extent of drying-ground, each moulder occupying about half an acre of land for this purpose only; and the extent of ground required gives to brick-works near London the title of brick-fields, and in the country that of brick-yards. Bricks are sometimes dried in hacks under sheds, but for large works, in which machinery is used for making them, the quantity of shedding required would be so great, that it would be better to erect more improved constructions.

When the brick is partially dry, and quality is a consideration, it is the practice in some works, where hand-making is adopted, to dress a portion of the bricks by hand with boards called tappers, or by means of a small machine called a brick-press, of which there are many excellent ones made. The brick is placed in a metal mould, and by means of a powerful leverage is subjected to considerable pressure, which gives it a very smooth face, and produces the best front bricks. Some of these machines have single, and others double moulds. I prefer the latter, as, while one brick is being pressed, the brick previously dressed is removed, and another fed in, which saves much labour and time over the single-mould press. Although these machines do not exert a tithe of the force employed by the dry clay making machines, we often see the bricks pressed by hand only, when made from plastic clays, blown to pieces, and their outer surfaces shelled off, from their not being able to be dried entirely throughout. Brickmakers should select their most loamy earths for making bricks which are afterwards to be pressed for front stocks. Pressed bricks must be thoroughly dried previously to their being placed in the kiln. A good machine produces bricks of such a quality as renders the above process unnecessary.

The drying of bricks ready for burning is a matter of great importance, and requires more attention than it generally receives. From hand-made bricks we have to evaporate some 25 per cent. of water before it is safe to burn them. In a work requiring the make of 20,000 bricks per day, we have to evaporate more than 20 tons of water every 24 hours. Hand-made bricks lose in drying about one-fourth of their weight, and in drying and burning about one-third. The average of machine bricks—those made of the stiff plastic clay—do not lose more than half the above amount from evaporation, and are, therefore, of much greater specific gravity than hand-made ones.

The artificial drying of bricks is carried on throughout the year uninterruptedly in sheds having the floor heated by fires, but this can only be effected in districts where coal is cheap. The floors of these sheds are a series of tunnels or flues running through the shed longitudinally. At the lower end is a pit, in which are the furnaces; the fire travels up the flues under the floor of the shed, giving off its heat by the way, and the smoke escapes at the upper end, through a series of (generally three or four) smaller chimneys or stacks. The furnace end of these flues would naturally be much more highly heated than the upper end near the chimneys. To remedy this, the floor is constructed of a greater thickness at the fire end, and gradually diminishes to within a short distance of the top. By this means, and by the assistance of dampers in the chimneys, it is kept at nearly an equal temperature throughout. Bricks that will bear rapid drying, such as are made from marly clays or very loamy or siliceous earths, will be fit for the kilns in from 12 to 24 hours. Before the duty was taken off bricks, much dishonesty was practised by unprincipled makers, where this drying could be carried on economically. Strong clays cannot be dried so rapidly. These sheds are generally walled round with loose bricks, stacked in between each post or pillar that supports the roof. The vapour given off from the wet bricks, rising to the roof, escapes. This system of drying is greatly in advance of that in the open air, for it produces the ware, as made, without any deterioration from bad weather, but the expense of fuel to heat these flues has restricted its use to the neighbourhood of collieries. In 1845 I turned my attention to the drying of bricks, and carried out experiments in drying the ware with the waste heat of the burning kilns. The caloric, after having passed the ware in burning, was carried up a flue raised above the floor of the shed, and gave off its spent heat for drying the ware. A model of my kiln and drying shed was exhibited at the Royal Agricultural Society's meeting at Northampton in 1847, by Mr. Bullock Webster, who was so pleased when witnessing it at work, that he asked my permission to have the model made to be exhibited. Although this kiln was most useful in proving that the waste heat of a burning kiln is more than sufficient to dry ware enough to fill it again, I was obliged to abandon it on account of the construction of the kiln not being good. This difficulty is now entirely removed, by a kiln which I shall have to describe presently.

Another system of drying is in close chambers, by means of steam, hot water, or by flues heated by fire under the chambers. I will, therefore, briefly describe the steam chamber as used by Mr. Beart. This is a square contruction, or series of tunnels or chambers, built on an incline of any desired length; and at some convenient spot near the lower end is fixed a large steam boiler, at a lower level than the drying chamber. From the boiler the main steam pipe is taken along the bottom or lower end of the chamber, and from this main, at right angles, run branch pipes of four inches diameter up the chamber, two feet apart, and at about three feet from the top or arch. From there being so close and shallow a chamber between the heating surface of the pipes and the top, and so large an amount of heating surface in the pipes, the temperature is soon considerably raised. At the top and bottom ends are shutters or lids, which open for the admission of the green ware at the upper end, and for the exit of the dry ware at the lower end of the chamber. Over the steam pipes are fixed iron rollers, on which the trays of bricks, as brought from the machine, are placed, the insertion of one tray forcing the tray previously put in further on, assisted in its descent by the inclination of the construction. The steam being raised in the boiler, flows through the main into those branch pipes in the chamber, and from the large amount of exposed surface becomes condensed, giving off its latent heat. From the incline given to the pipes in the chamber, and from the main pipe also having a fall towards the boiler, the whole of the warm water from the condensed steam flows to the boiler to be again raised to steam, sent up the pipes, and condensed intermittently. The steam entering at the lower end of the chamber, it is of course warmer than the upper end. Along the top end or highest part of the chamber is a series of chimneys and windguards, through which the damp vapour escapes. The bricks from the machine enter at this cooler end charged with warm vapour, and as the make proceeds, are forced down the chamber as each tray is put in. Thus, those which were first inserted reach a drier and warmer atmosphere, and on their arrival at the lower end come out dry bricks, in about 24 hours, with the strongest clays. In some cases the waste steam of the working engine is sent through these pipes and condensed. Bricks will dry soundly without cracking, &c., in these close chambers, when exposed to much greater heat than they would bear on the open flue first described, or the open air, from the circumstance of the atmosphere, although very hot, being so highly charged with vapour. In practice these steam chambers have proved many principles, but they are not likely to become universal, for they are very expensive in erection on account of the quantity of steam pipes, and involve constant expense in fuel, and require attention in the management of the steam boiler; but their greatest defect is the want of a current of hot air through the chamber to carry off the excess of vapour faster than is now done. The attaining a high degree of temperature in these chambers is useless, unless there is a current to carry off the vapour. Why should this piping be used, or steam at all, when we have a large mass of heat being constantly wasted, night and day, during the time the kilns are burning? and after the process of burning the kilns is completed, we have pure hot air flowing, from 48 to 60 hours, from the mass of cooling bricks in the kilns, free from carbon or any impurities; this could be directed through the drying chambers, entering in one constant flow of hot dry air and escaping in warm vapour. The waste heat during the process of burning can be taken up flues under the chamber, and thereby all the heat of our burning kilns may be economised, and a great outlay saved in steam pipes, boilers, and attention. It must not be forgotten also, that so large an atmospheric condenser as the steam chamber is not heated without a considerable expenditure in fuel. This drying by steam is a great stride in advance of the old flued shed, but practical men must see the immense loss incurred constantly from this source of the spent heat of the burning kilns, and that by economising it, an immense saving will be effected in the manufacture. The kilns are constructed as near the lower end of these chambers as convenient.

A kiln for attaining the object of the one I built in 1846 is now at work at Epsom, at Mr. Hand's brickworks; but with this difference, that the smoke is consumed. The drying shed is kept quite close, that the hot flues may raise the temperature so high as to dry the ware. In this kiln the heated gases escape from the top, after passing up through the ware, into a flue, and are carried to the ground, and thence into the drying shed, which is a very large construction in proportion to the size of the kiln, and holds nearly sufficient ware to fill four kilns. In this shed the heat passes up a hollow wall, about six feet high, and after running through the length of the shed on one side, returns down a similar flue on the opposite side of the shed, and is again carried to the kiln, through the bottom of which it passes in two close flues between the three kiln-furnaces, with the exception of small apertures through which the heat enters to consume (as I am informed) the smoke; but I have not been able to see it at work, and therefore cannot speak on this point. I fear there must be a loss of heat to consume this smoke, which has travelled some 300 or 400 feet; this should be done in the furnace before it enters the ware, and so be economised. From these return flues the spent gases rise up a shaft at the end of the kiln. One result of carrying this return flue through the kiln, is the attaining a great draft or suction in the flues to carry off vapour. If Mr. Hands were to erect three more kilns, and so work four into his present drying-house, he could always have it highly heated; as one kiln would be burning and another cooling continually, while the other two were being respectively filled and emptied. By this means he would realise a much larger return from his spent heat. He has now to raise the temperature of the whole construction each time he burns, from that of the atmosphere to a drying heat of about 90 degrees.

The burning of bricks is exposing the clay to such a degree of heat as to change its character from a merely absorbent lump of dry earth to a hardened, indestructible, partially vitrified mass, or artificial stone, which will withstand the action of the atmosphere. The effect of fire on clays, or brick-earth, varies with the proportion and number of earths and salts of which they are composed, and the different per centage they bear one to another. Clay, or pure alumina, is infusible, but on exposure to great heat, contracts greatly in bulk. It is this property which regulates the action of Wedgwood's pyrometer. Alumina combined with silica, or alumina combined with lime, will withstand the most intense heat which can be obtained in a furnace; but if we mix these three earths, alumina, silica, and lime together, they then melt at a very low heat; the lime acting as a flux on the silica; and, according to Dr. Ure, in his Dictionary of Arts, the more readily the nearer the mixture approaches the following proportions, viz.:—Alumina $\frac{1}{5}$, lime $\frac{1}{5}$, and silica $\frac{3}{5}$; by adding two parts more of sand, it becomes infusible. The Devonshire and Dorsetshire plastic clays are composed of silica $\frac{3}{4}$, and alumina $\frac{1}{4}$; they burn very white, and form the basis of earthenware.

The clays and marls generally made into bricks contain protoxide of iron. If a clay has a large per centage of iron, and a small per centage of lime, the silica and alumina, the body of the ware, will withstand a much higher temperature than is required to flux the iron. By attaining a sufficient heat the iron melts and completely cements all the pores, giving the brick a metallic coating; so that on being immersed in water these bricks are very slightly absorbent. The bricks made from London clay, about Uxbridge, and burnt in what are called close fire-clamps, take from 10 to 15 degrees Wedgwood to burn them sufficiently hard; the fire-bricks of Stourbridge take 85 degrees; the vitrified blue bricks of Staffordshire 95 degrees; and the vitrified bricks of North Wales require

120 degrees Wedgwood, or the same heat as an iron smelting furnace. It will be seen, from what I have stated, with how varying a material we have to deal. In one case we have to attain the heat of the smelting furnace, and in another we are not much to exceed a low red heat, or the whole of the kiln or clamp would become one lump of useless slag. Clays contract in the burning as well as in drying; in order to correct this, therefore, it is desirable to work up sufficient silicates, as loam, sand, &c., with strong clays or very plastic earths. A good tile clay, that will dry and burn soundly in a thin body, or a perforated brick, will fly in the fire in so large a mass as a solid brick.

In the case of refractory clays, if, as soon as the kiln is burnt, a little common salt is thrown into the fires, from the intense heat of the interior it is immediately volatilized; the kiln then being closed up, and the fumes retained, an effect is produced on some clays of glazing the bricks, and on others of changing their colour, particularly if the clay is charged with iron, to a much darker hue, the soda acting as a flux on the iron and silica; for the effect of the chlorine we must appeal to the chemists. Stone ware, or Dorsetshire clay, takes a salt glaze. Salt must be very cautiously used, until its action on the clay is proved, for brick earth becomes much more fusible when exposed to the vapours or gases from salt, and will be in danger of being melted. The use of sulphurous coal for brick-burning is esteemed by many makers, from the bricks having a harder appearance and better colour. The colour to which bricks are burnt, varies throughout the country. In London the white bricks are esteemed, although from the smoky atmosphere they soon obtain a different hue. Suffolk, Devonshire, Dorsetshire, Cambridgeshire, and Essex, produce white bricks of the best quality. The general colour of bricks throughout the country is red, but in Staffordshire, Shropshire, Worcestershire, and other coal districts, they are what are termed blue bricks, and are of the colour of cast iron.

The chemical action of salts thrown into the fires of brick-kilns for the purpose of fluxing, or burning the ware at a lower temperature, or giving a better colour or appearance to the bricks, has not been sufficiently experimented on. This should be undertaken by the chemist, as the brickmaker, without his assistance, may try many useless experiments.

To explain fully the various processes of firing adopted for the different classes of earths, or more generally the different districts of the country, would occupy more time than the limits of this paper will allow. Each county adopts a distinct mode; and in some counties there are used two or three different constructions of kilns, or principles of firing the ware. I will, therefore, briefly allude to the general systems adopted, and more particularly explain those improvements which have taken place, and stood practical proof of their utility. A subject which has formed the basis of 230 patents cannot be fully explained in so brief a space. Besides this there are many improvements not protected by patents.

For burning bricks, we have to employ the utmost care and attention in exposing them to as high a heat as they can stand without endangering their melting. If they are not sufficiently burnt, they will be very absorbent, and will retain sufficient moisture for a frost to destroy them.

The burning is carried out on two principles:—1st. In the neighbourhood of London and Manchester, by what are termed close fire clamps; that is, with as little draft as possible, or by a smouldering fire which occupies a month or six weeks in burning, having the fuel spread in layers between the bricks. The other system is by a draft of hot air or flame from furnaces or fire-holes in square or circular buildings, called kilns.

Of these there is an endless number of constructions; some nearly approach the close fire clamps, having a very slow draft, and take a week or nine days to burn them. Others have an increased draft, and take four or five days; and the more recent constructions effect the desired object in from forty-eight to seventy-two hours.

The close fire clamp is the favourite system around London and Manchester for burning bricks, which arises from these large populous cities supplying the brickmaker with a very cheap fuel in the shape of the refuse ashes from the houses and the manufactories, and also from the clays in these districts taking little fire to burn them. The London makers not only burn by layers of the ashes between the bricks in the clamp, but, as I before mentioned, add in the making, about 30 per cent. to the clay before it is moulded. Around Manchester, ashes are not used in making the bricks, but only in burning them. I think it quite superfluous to describe the setting or constructing these clamps; it would occupy much time, and the fewer we have of them, the better bricks will be supplied. But the principle is to stack the bricks close together, and to check the draft as much as possible, the fuel being intermixed with the ware. The wind is often very troublesome with clamps, and drives the fires to one side, by which that is over-burnt and the other side almost useless from not being burnt enough. I have not had any experience in these clamps myself, but I am informed by those practically acquainted with them, that the inferior (that is, the over and under-burnt) bricks are often in a proportion of from 30 to 50 per cent.; and these have to be sold at a reduced price. This irregular firing produces the numerous qualities of bricks which I described in my previous paper. All are made equally well, but are destroyed by the unequal heats to which they are exposed. The heat at which the bricks are burnt, varies in the London close fire clamps from 5 to 20 degrees. That the close fire clamp is the worst system of burning bricks few can doubt; and it would not be so tenaciously adhered to around London and Manchester, but from the supply of ashes being so great and so cheap. As a proof that the system is not good, the brickmakers in the collieries all use kilns, even where they have in their works refuse coal free of cost. But they cannot sell their bricks unless they are of good quality; they, therefore, use the kiln with a quick draft.

On visiting the brickworks at Epsom a few weeks since, to inspect the kiln which I have described to you, I was quite convinced that my opinion was right with respect to close fire clamps. The bulk of the bricks made in these works are burnt in the clamps, and a portion in the kiln. The most casual observer could not but be struck with the difference of the ware. Before I leave the subject of close fire clamps, I may mention that the London ashes could still be used by their being ground up fine amongst the clay; and then a very small quantity of fuel in the furnace of an improved kiln would burn the bricks of one uniform quality, and enable the waste heat to be economised for drying the green ware. The ashes, as they are now used, have their particles too large; and these, on being consumed, leave the bricks full of cells, and less compact and solid than other bricks.

The burning kilns are generally rectangular brick constructions, either open at the top or arched over, but some are circular buildings, or cupolas, called "ovens." It would take a whole evening to describe every one, and the different systems adopted in each; I will, therefore, only briefly explain the burning of an improved square kiln, and of a round one. The construction of the kilns cannot be correctly explained without drawings. The square kilns for large works, as erected by Mr. Beart, are built in pairs, to save one wall; they have the furnaces along one side, and the centre wall supports the two arches of the kilns. When they are thus built together, one is burning while the other is being discharged and filled, the cool kiln acting as a buttress to the burning one. The late Dr. Cother, of Gloucester, built a pair of these kilns under one arch. The bottom of the kiln is constructed with furnaces every five feet from centre to centre, and built with fire bricks. Above the fires, and about five feet from the bars of the furnace, is the floor of the kiln, supported on walls running through the length of the kiln, about 4 inches apart, and in these walls are arches at each furnace. The walls are tied together by the lattice work of the floor of the kiln, and the ends of the bricks, forming the open floor, are kept about three inches from each other. Through these small holes the flame from the furnace enters the goods to be burnt. The height from the open floor to the top of the arch is about 15 feet, and the vertical walls are from 12 to 14 feet apart. Thus a large space is allowed, as they can be built of any desired length. These kilns are constructed to hold from 50,000 to 200,000 bricks each, and are capable of being burnt from 18 to 20 times in a year. The arches of the kilns have a row of small chimneys, about three feet high and five feet apart, built down the centre, and a similar number on each side, through which the waste heat and gases escape.

The first process is to fill the kiln, which is called "setting." The bottom rows of bricks are kept wide apart over the floor, to allow the flame to enter more freely. On these are placed one or two rows of bricks, crossing the course on the floor, and about ¾ of an inch apart. Every one or two courses are then crossed, so that the fire has to pass through a series of net work, formed in the setting of ¾ inch squares. When the kiln is filled, the entrance, called the "wicket," is built up close with burnt bricks, and plastered over with loamy clay. The fires are then lighted in the several furnaces, and for 24 hours are allowed to burn very gently, but gradually increased, air being admitted, that the draft or warm current may drive off the steam as fast as it is formed, for bricks cannot be *thoroughly* dried previously to their being stacked in the kilns. When the steam ceases to flow from the top chimneys, the fire is gradually increased, and the heated gases flow with greater velocity through the ware. At this time the judgment of the burner is called into requisition, for if his furnace should become too hot, he may vitrify the bottom bricks, while those at the top of the kiln, 20 feet from the fire, would be quite unburnt. This he prevents by opening his furnace lids, and allowing a current of air to enter sufficient to cool his furnace. He then again closes the lid, in order to attain what heat he can safely use. These operations of heating and cooling are continued until, on looking at the top chimneys of his kiln, he sees that he has attained a sufficient heat. After this he gives the kiln a few hours more fire, but gradually admitting more air, which begins to lower the temperature of the bottom part, and, from the increased draft, carries the heat to the arch, and thoroughly burns the top bricks. I have often seen these top bricks, 20 feet from the fires, harder burnt than those on the floor of the kiln, within 5 feet of the fire. After the burning is completed, the fire doors are shut to prevent the kiln cooling too rapidly, and for two or three days it is pouring off to *waste* an immense amount of heat, free from all impurities. When the kiln is cool, the wicket is taken down, and the ware drawn out for use. With a good burner the bricks will all be of equal quality, and, if well made, will all command the highest price, not a moiety only, as in clamp burnt bricks.

The common brick kiln is a rectangular building, generally open, but sometimes arched over. In the side walls and opposite to each other, are built fireplaces, or holes for the insertion of the fuel. The furnaces are formed in the setting of the kiln with unburnt bricks, and above these the kiln is filled as above described. In these kilns, from the raw ware forming the furnace, the flash of the flame, from the fires in the walls, too often vitrifies and destroys the nearest bricks. In the open kiln, as the fire or heat reaches to the top, the fireman soils or earths it down, which throws the draft to another part more backward; and, as it continues to rise, he proceeds with this operation until all the top is earthed in; he then continues the firing until the whole has sunk, by the contraction of the clay in the fire, to the desired depth. The fire-holes are then stopped up with mud, and the kiln is left to cool gradually. If the air were admitted too rapidly while the kiln was at this intense heat, it would cause bricks, made with strong clays to fly to pieces like glass; it is, in fact, the process of annealing. Cooling too quickly also affects, in many clays, the colour of the bricks.

Temporary kilns are constructed in the country with unburnt bricks, and called clamps. In Staffordshire, the bricks are burnt in small round kilns, called ovens, which hold from 7000 to 8000 bricks each; these are burnt from fire in the walls round the ovens, and the raw ware is set in, so as to form a flue from each fire, to direct the flame to the centre. These ovens burn very quickly, and a most intense heat can be obtained in them.

I will now more fully describe a principle of burning which I have had in practice for the last six years, and which I can therefore recommend with great confidence. The great object in brick-burning is to attain a sufficient heat to thoroughly burn the ware with as small a consumption of coal as possible; and with nearly an equal distribution of the heat over all parts, so that the whole of the ware, being subjected to the same temperature, may contract equally in bulk, and be of one uniform colour throughout. The advantage is also gained of burning in much less time than in the old kilns, which, on an average, took a week; and the management is so simplified that any man, even though not at all conversant with the manufacture, after he has seen one kiln burnt, will be able to manage; and the last, though not least, advantage is, that of delivering up to us the waste heat at the ground level, or under the floor of the kiln, to be used in drying the green ware, or in partially burning the next kiln.

Hitherto the heat has been applied by a series of fireplaces, or flues and openings round the kiln, each exposed to the influence of the atmosphere; and in boisterous weather it is very difficult to keep the heat at all regular, the consequence of which is, the unequal burning we often see. The improvements sought by experimentalists have been the burning the goods equally, and, at the same time, more economically. These are obtained by the patent kilns, as improved by Mr. Robert Scrivener, of Skelton, in the Staffordshire Potteries. The plan is both simple and effective, and is as follows:—A furnace is constructed in the centre of the kiln, much below the floor level, and so built that the heat can be directed to any part of the kiln at the pleasure of the fireman. First, the heat is directed up a tube in the centre to the top of the oven or kiln, and, as there is no escape allowed to take place there, it is drawn down through the goods by the aid of flues in connection with a chimney. Thus, all the caloric generated in the furnace is made use of, and, being central, is equally diffused throughout the mass; but, towards the bottom, or over the exit-flues, the ware would not be sufficiently burnt without reversing the order of firing. In order to meet this requirement there is a series of flues under the bottom, upon which the goods are placed, with small regulators at the end of each; these regulators, when drawn back, allow the fire to pass under the bottom, and to rise up among the goods which are not sufficiently fired, and thus the burning is completed. By means of these regulators the heat may be obtained exactly the same throughout; there is, therefore, a greater degree of certainty in firing, and a considerable saving of fuel, with the entire consumption of the smoke. From the fire or draught being under command, so as to be allowed either to ascend or descend through the ware during the time of burning or cooling, the waste caloric can be economised and directed through the adjoining kiln in order to partially burn it, or be used in drying off the raw wares on flues or in chambers. I have found the saving of fuel in these kilns over the common kiln, 50 per cent.; and to give an idea of the facility with which they can be worked, it is common for my men to fill the kiln, burn, cool, and discharge it in 6 days. But the time I usually allow is, to have each kiln set, burnt, and drawn in seven days.

I have obtained from the manager of the Lilleshall Company a report as to how these kilns answer for burning the Staffordshire blue bricks, which I will read to you:

Prior's Lee, near Shiffnall, May 13, 1856.

SIR,—I have the superintendence of two sets, of four ovens each, at the Lilleshall Company's works here. Each of these ovens will contain from twelve to thirteen thousand bricks, and require from seven to eight cwt. of small coal to burn each thousand, the time occupied in burning being about twenty-four hours. This short time is accounted for by the spare heat passing from one oven to another, and thoroughly drying the bricks before the fire is put in the grate. One set of these ovens has been at work for the past five years; the only repairs required in that time being the tube, and this is trifling. Not one grate-bar has had to be replaced. The old brick ovens at this work would contain about 7,000 bricks; one ton of coal per thousand was required, and three days and two nights to burn them. Unless there are some greater improvements than Mr. Scrivener's out in brick ovens, his certainly must rank No. 1.

Yours truly,

WM. TIPTON.

H. Chamberlain, Esq., Kempsey, Worcester.

In these works the saving of fuel is 60 per cent., and of time 36 hours.

To sum up the manufacture of bricks on the most improved system, the whole works should be under one roof, and only occupy a fraction of the space devoted to this manufacture in the field. The brick manufactory may be a square construction, a fourth of which, across the top, would be occupied by the steam-power mills and machines, with an allowance for working room; one-half would be used for drying the ware, and the remaining quarter for kiln-room. The clay should be brought into the works from the pit by trucks, on a light railway, of which some excellent ones for the purpose are manufactured by Mr. Crosskill, of Beverley, the celebrated agricultural implement-maker. It should then be manufactured into bricks by machinery, and delivered to a drying chamber, or laid on open flues (the latter being the cheapest in construction), in order to be dried, the flues or chambers being heated by the waste heat of the burning kilns. As soon as the bricks are dry, they should be stacked in the kiln, burnt, and delivered out, at the opposite end of the manufactory to that at which the raw clay entered, ready for use. This can be done in from eight to nine days from the time when the clay first entered the works; being a very little more time than is occupied in burning alone in many districts.*

To attempt to give the cost of manufacturing would only mislead. The largest item is labour, the cost of which varies so much between manufacturing and agricultural districts. The next is coal or fuel for burning, which ranges from 3s. to 20s. per ton, according to the district of country. Again, one clay requires a large expenditure of fuel to be used, in order to attain the most intense heat; while another will burn sufficiently hard at about 10 degrees Wedgwood. The consumption of coal for burning bricks varies with the clays, from 3 to 20 cwt. per 1,000.

There are but very few places having much demand for bricks where the trade is monopolised. Competition prevents the brickmaker realising more than a reasonable profit for his industry and risk in manufacture.

Taking the duty off bricks has led to many improvements in the manufacture of them. We could not have used drying chambers, as the excise officer would not have been able to count the bricks. Nor could the bricks have been taken to the kilns from the dry-clay machines, as the duty was charged on the raw ware.

It was expected that, on the removal of the duty, ornamental bricks would have become a general manufacture, but this is not likely to be the case with machine-made bricks, for the reason I gave in my paper on the making, from the clay not being able to be expressed through dies with edges sufficiently sharp, on account of the large amount of friction. The attempt to mould by machines would require such quantities of large expensive moulds as would raise the price, to remunerate the manufacturer, so high that he could not compete with stone. After these ornamental blocks of clay have been moulded, it is necessary that they should be all exposed to the same heat in the kiln, as one block may contract so much more than another, that on their being placed in a building, all truth in the outline would be lost, and the appearance would be unsightly. I think architects, builders, and brickmakers will be unanimous on this point, that the great aim should be to improve the quality of the brick, and leave the production of the ornamental decorations of our buildings to the potter, as a distinct manufacture.

The smooth bricks used over the doors and windows of many houses are produced from very siliceous earths, which when burnt are so soft that they can readily be rubbed on a stone to any desired angle and face; they are called "rub-and-gage" bricks. Clays of this class, which are composed of sand and a very small portion of alumina, are manufactured into fire-bricks, and are called Windsor fire-bricks.

Another very siliceous earth, the deposit of the tide at Bridgewater, is moulded into bricks for cleaning knives, called Bath bricks, though made only at Bridgewater.

Before concluding this subject, I may mention that for the last few years we have been constantly informed through the press of the wonderful pressure the hollow and perforated bricks will sustain more than the solid ones. I believe these experiments have all been carried out with a machine-made hollow or perforated brick against a hand-made solid brick. The perforated brick being manufactured from stiff clay, by great pressure, is of a much higher specific gravity than the hand-made one, which was manufactured from soft mud, and having undergone excessive evaporation, was consequently very porous. Nor would these experiments be fair, even if a machine-made solid brick were tested with a machine-made perforated one, unless they had been both manufactured from the same lot of clay, and burnt in the same heat; for five degrees difference in the firing of the bricks would considerably affect the pressure which they would sustain.

Mr. Beart has kindly supplied me with a copy of the report on the weight required to crush his perforated brick made at Arlsey, and commonly used in London, and a London stock-brick, which I will read to you:—

"*Experiments testing the relative bearing powers of perforated and solid bricks, by hydraulic machine, at the works of Messrs. Cubitt and Co., 10th November*, 1853.

"EXPERIMENT No. 1.—Perforated bricks from the works of Messrs. R. Beart and Co., Arlsey, somewhat red in colour, were subjected to a pressure of sixty tons. When removed, one brick was cracked in the middle, the other perfectly sound.

"No. 2.—Paviours. These were subject to a pressure of 60 tons, but both bricks were found considerably broken.

"No. 3.—Best London stocks. These were crushed to fragments under a pressure of 37½ tons.

"No. 4.—Perforated bricks from the Arlsey works, differing from No. 1 in being white instead of red. Removed entire, after the full weight of 60 tons had been applied.

"In each case, two bricks were used cemented together on the flat or bearing surface, and the test limited to 60 tons, the machine not being adapted to a greater force without danger of its giving way.

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* The quality of bricks depends on the fineness of division of the particles, the proper admixture of the earths and their thorough amalgamation, the closeness or compactness into which they are worked, and finally the having been exposed to a sufficient heat to render them indestructible from exposure to any change of atmosphere.

"The results proved the greater resisting property of perforated over solid bricks; thus showing their special fitness for large buildings and other works where there is great superincumbent weight."

As I had never heard of any report which I considered an accurate test, I had a heap of clay of equal quality manufactured by the machine before you, one-half into solid and the other half into perforated bricks. When dry, they were burnt together in the same part of the kiln, and on six bricks of each sort I placed pyrometers, so that the result was that they were all burnt in equal heat of 30 degrees Wedgwood. I will now read the report of Messrs. Horner and Molesworth, the civil engineers, of Beaufort-buildings, in the Strand, who have been kind enough to test for me the power required to crush these bricks by hydraulic pressure:—

"*Report on Experiments to determine the Relative Strength of Solid and Perforated Bricks.*

13, Beaufort-buildings, Strand,
June 10th, 1856.

"Sir,—In accordance with your request we have instituted a series of experiments to determine the relative strengths of solid and perforated bricks. To do this, we have deemed it necessary to expose the bricks experimented upon to a transverse as well as a crushing strain. From the results which have been obtained from similar experiments made by Mr. Cubitt and Sir John McNeill, we have every reason to believe that in those trials the *machine*-made perforated brick was tested in comparison with the *hand*-made solid brick, which of course resulted in favour of the machine-made brick; hence the inference has erroneously been drawn that the perforated brick is stronger than the solid. If, however, the comparison is made between machine-made bricks only, it will be found that such is not the case, the solid brick being much stronger than the perforated, as our experiments incontestibly prove.

"We have also made experiments with the London hand-made stock-brick, as well as the Staffordshire brick, also made by hand.

"The experiments were made with a 9-inch hydraulic press; the plunger by which the pressure was applied was one inch in diameter, and the weight was suspended to a lever, which multiplied the power 15 times. In applying the transverse strains, however, a shorter lever, which only multiplied the power by 5, was used. The bricks subjected to a crushing force were faced, so as to remove all inequalities; they were then bedded on a sheet of thin lead, and another sheet placed upon them.

"The pressure was communicated by a cast-iron plate, so arranged as to adjust itself to the brick, and distribute the pressure uniformly over the whole surface. The weights were carefully applied, and allowed to come to a full bearing before more were added.

"In exposing the bricks to a transverse strain, the supports were placed two inches apart, and the weight gradually applied to the centre by means of a spring balance.

"The results of the experiments are shown in the annexed tables:—

Bricks exposed to Crushing Strain.

No. of Expt.	Description of Brick.	How made.	Weight of Bricks.	Temp. of Kiln.	Crushing Weight.			
			lbs.		tons.	cwt.	qr.	lbs.
1	Worcestershire, perforated......	Machine	6	30 W*	45	3	0	0
2	Ditto solid.........	Machine	8¾	25 "	62	14	3	0
3	Ditto solid.........	Machine	8¾	30 "	117	5	0	0
4	Ditto perforated.	Machine	6	30 "	47	17	1	11
5	Lond. stock solid	Hand.	5¾		13	3	0	0

* Wedgwood.

Bricks exposed to Transverse Strain.

No. of Expt.	Description of Brick.	How made.	Weight of Bricks	Temp. of Kiln.	Breaking Weight.			
			lbs.		tons.	cwt.	qr.	lbs.
6	Perforated Wors.	Machine	6	30 W.	3	15	2	20
7	Solid ditto.........	Machine	8¾	30 "	9	3	2	19
8	Perforated ditto	Machine	6	30 "	3	5	2	5
9	Perforated ditto.	Machine	6	30 "	2	3	3	15
10	Solid Staffordsh.	Hand.	9½		2	4	0	19
11	Solid ditto.........	Hand.	9½		4	8	0	5
12	Solid Worcester.	Machine	8¾	30 "	9	17	0	19

"In experiments Nos. 3 and 4, the cast-iron plates through which the pressure was communicated broke with the final strain.

"The brick used in experiment No. 5 was not faced, and as it was 'dished' on the upper surface, the pressure was not uniformly distributed over the surface.

"The bricks termed Worcestershire are those supplied to us by you from the works of the Earl of Coventry.

"We have the honour to be, Sir,
"Your obedient servants,
"HORNER AND MOLESWORTH,
"*Consulting Engineers.*
"H. Chamberlain, Esq."

In conclusion, I much regret that this subject has not fallen into abler hands. I have endeavoured to explain it as concisely and practically as I could in the brief space of time allotted to so wide a subject.

Many inventions and many improvements, I know, are being practically worked, in different parts of the country; but if I had entered on all, the papers would have been a mere catalogue of inventions connected with the brick manufacture.

I fear, also, that I have not explained these matters with sufficient clearness, but I must solicit your indulgence, and plead as my excuse that I am more accustomed to carrying out these matters in practice, than to writing upon them.

DISCUSSION.

Mr. **Beart** said he would briefly state his experience in his works during the last 15 or 20 years. About 1832, he first introduced machinery in connection with the manufacture of drain tiles, and particularly turned his attention to the subject now under notice. He then came to the conclusion that the great object to be attained in the manufacture, both of drain tiles and of bricks, was facility for drying the ware. The machinery to be employed in the manufacture was nothing more than that which the genius of individuals would apply to the particular circumstances under which they had to work. A machine which might be worked with advantage in one locality, would be of no use in another; but, as far as his own experience went, he had never found any difficulty in bringing machinery to bear under any circumstances in which he required it. The great difficulty he had experienced was in drying the material in the open air, and making brick works (which should be their object) not mere *brick-yards*, but *brick factories*; that was, that the process should be continuous, and go on from day to day throughout the whole year without interruption. He might state that, at the present time, and for the last two years past he possessed the means of drying 500,000 per week in the winter, and a much larger number—if required—in the summer time. In two works, during the last two years he had not been stopped in his operations for a single day; and therefore it might be supposed that he had paid no inconsiderable amount of attention to the subject of drying. He would briefly give them the result of his own experience in drying, which he regarded as the great desideratum in brick-making, and also in tile-making. When he commenced tile-making, in 1832, he had large sheds erected with shelves, which was the then system of drying; and these shelves, if extended in a straight line, would reach to a distance of 10 miles, and calculating 12 tiles to the yard, he had the means of keeping 200,000 tiles, as it were, in stock, in course of preparation, to go to the kilns as required: but with all these means he was only a summer manufacturer; it was a brick-yard, and not a brick-factory. He subsequently removed the whole of the shelves, and turned the whole of his sheds into hacks, and set the tiles one upon another, by which means he could dry 800,000 tiles if required. He continued that system up to 1842, from which period, he considered the improvements in brick manufacturing commenced, and his experience, after all, had proved that brickmaking was a question of drying. In 1850, he took out a patent for a particular description of drying shed, which had been partly explained by Mr. Chamberlain, but not quite correctly. The patent was confined to the construction of the flues with a certain inclination: the bricks were placed on trays and put in at one end of the flue, gradually descending until they came out at the other end. In these works he made use of stoves, and the heat passing entirely through the flue caused such an amount of ventilation that there was no accumulation of steam in the heating flues. Some persons had introduced the use of coal; but he had himself used coke for the purpose of heating, because, in the use of coal, the flues were liable to be choked up with soot. Where parties had introduced steam for the purposes of drying, they were quite right in using coals, because, instead of giving 18s. or 20s. a ton for coke, they could buy inferior coal in Staffordshire to generate steam at about 3s. a ton, and, therefore, steam in those districts was cheaper than the use of coke in flues for drying; but in his own neighbourhood, where he could buy coke at about the same price as coal, and coke containing more caloric than coal, he found it cheaper to use coke, while the process was more simple than by the employment of steam. Where steam, however, was used, the imperfection, he believed, in the steam apparatus, did not arise from a fault in the principle, but from a defect in the construction of the works by those who adopted steam without taking means to provide for the thorough ventilation of their flues. He agreed with almost everything which had been stated by Mr. Chamberlain on this subject. As he had before stated, his (Mr. Beart's) great object had been to make brick works factories—that instead of men being employed in the drudgery of making bricks, they should all be made by machinery. With regard to the railway of Messrs. Crosskill, he had never found it necessary to adopt any particular system of railway. He commenced by drawing the clay from the pits at various depths, from 20 to 60 feet. He simply laid a course of trams in the direction required, and laid down common contractors' rails, which were cheap, or simply bars of iron nailed on the timber, and by means of waggons on the trams the clay was brought to the rollers. After passing through the rollers it went into the clay chambers, thence to the machine, and from thence the bricks passed into the flues, then to the kilns, whence they were delivered into railway trucks; and thus a complete brick factory was established, the operations of which were continuous, let the weather be what it might. He now came to the question of burning the material. With regard to burning, small kilns, which would only burn 10,000 or 15,000 bricks at a time, would be of very little use to him, and he should find great difficulty in applying the waste heat of the kilns to drying the bricks in flues, from the great irregularity of the heat at different stages of the burning. Where they had a large establishment, producing 100,000 bricks per day, there would be great difficulty in dealing with this irregularity, because if they interrupted the drying, they interrupted the operations both of the machines and the men. They must have each department dependent upon the other, so as to form a continuous whole. Mr. Chamberlain had spoken of thirty-six hours for the drying and burning. He (Mr. Beart) was, however, placed in that position that it took eight days to anneal the goods before he could apply to them heat of an intense character, and then they must be burned for a period varying from 48 to 72 hours, in order to get the colour of bricks he had exhibited—one being red and the other white. In the clay he used there was a small quantity of oxide of iron, which, owing to the proportion of lime it contained, would sustain a certain degree of heat, until the oxide of iron was drawn off or precipitated. This clay produced the specimen of white brick before them. Bricks were also produced from the same kilns only partially marked with white. The action of fire upon bricks produced various effects in different localities. In Staffordshire, where they wanted a beautiful red colour, they placed the face of the bricks together in the kiln, and obtained the colour by preventing the fire from coming in contact with the bricks; but in Cambridgeshire, Huntingdonshire, Hertfordshire, and other localities, they could only produce the white colour required by the fire being brought into contact with the bricks. The action of fire was different upon different clays, and thus the colour required was produced. With regard to the crushing experiments which had been introduced in connection with this subject, he did not pretend to say that a perforated brick would bear an equal test to a solid brick, if the density of the two bricks were the same; but he would tell them, in his opinion, it was impossible to make bricks, of the density of the Worcestershire solid brick, commercially profitable. They had heard mentioned the different means made use of for compressing the bricks. If they made bricks under a great pressure, it had little to do with the density of the article. The density depended upon the clay being thoroughly broken down and rendered perfectly impalpable before it was made into bricks; because, if clay had moisture in it, they could not compress it to any advantage. Ordinary earthenware was far more dense than any description of brick, and yet it underwent no pressure whatever. In that case the clay was reduced to an impalpable state, and consolidated itself without any pressure, simply by contraction, drying, and turning. With regard to the so-called American system of making bricks by compression, which had been introduced into this country, he had been solicited, about twenty years ago, to adopt the same by Mr. Prosser, who took out a patent, which was called the "Adhesion of Cohesion," and which Messrs. Minton and Co. had, in a modified form, applied to the manufacture of tiles, buttons, and other articles. So far, therefore, from its being an American invention, it was only an old process patented in England; and by this process the manufacture of bricks was very expensive. If they had not to dry the bricks, they had to dry the soil of which they were made. They had also to grind and sift it, and to bring it to a state that it would work in the moulds. In the year 1833 or 1834, an American gentleman did introduce into this country a machine for compressing bricks in a partially-dried state. His system was, when the bricks were about half-dry, to stack them up until they became of an uniform state of dryness; by then passing them through moulds upon which great pressure was applied, a smooth surface was obtained, and, as little contraction took place afterwards, the form was perfectly retained. In conclusion, he would remark, that he considered the whole theory of the advancement of the brick trade must be, where the nature of the clay or soil would admit of it, to reduce the operation to that of a factory. In order to do that, the question was one of drying, and in this respect it was necessary to consider some of the natural laws which regulated the drying of the material. All plastic earths contracted in the drying from the surface—that was, they could not get the moisture from the interior of the brick before the outside contracted and fissures were formed. An illustration of this might be seen in a clod of earth in the summer-time; they would find on the outside fissures in which they could put their finger, but these did not extend to the interior. Therefore, difficult as was the question of drying bricks, but for the contraction which took place by the evaporation of moisture, the surface of the earth could not be cultivated.

Mr. Axton said he considered there were several objections to be made to Mr. Chamberlain's system, so far as regarded London. It might answer very well where coals were cheap, but this was not the case here. Assuming the number of bricks made in and about London to be two hundred millions, (and this, he believed, was a tolerably correct estimate), and allowing half-a ton of coals for each 1000 bricks, for drying and burning, the consumption of coals would be increased by one hundred thousand tons. This, he considered, would cause a material increase in the price of coals in the metropolis. By the existing method, not only was this enormous consumption of coals avoided, but, at the same time, all the refuse dust and ashes were profitably turned to account, and thus much noxious material was got rid of without difficulty and without cost. He also considered that the estimated waste for inferior bricks, &c., of 25 per cent., was too large, except when there was mismanagement, or the dust contractors adulterated the breeze and ashes by mixing with them materialsunfitted for the manufacture.

Mr. C. H. Smith said, although he was neither a brickmaker nor a bricklayer, still he had for many years past been a great deal connected with building. Much had been said in the paper as to the crushing power which bricks would sustain. He did not for a moment question the accuracy of the statements respecting the experiments made in the present instance, but he had reason to know, from experience, that the crushing power of this sort of material varied in different specimens of the same substance, and with regard to bricks the results could not be depended upon unless they were deduced from a number of experiments. One brick might crush at half the weight which another brick would sustain. He questioned the dependence to be placed upon experiments made with the hydraulic press. He thought great accuracy of calculation could not be obtained, as the slightest variation in any of the dimensions would affect very materially the result. He was inclined to think that the crushing power which bricks were capable of sustaining, with reference to their value for building purposes, was considerably over-rated. He was not aware of a single instance of what might be called a fair crushing of bricks or stone in a building. If the foundation gave way there might be a crack from top to bottom, but both those materials would bear a considerably greater weight than was required of them in a building. As a proof of that, he might instance the lowest pressure at which the bricks exhibited had been crushed, viz., 13 tons. By calculation they would find that in a building, even if the work were done in an inferior manner, 13 tons were considerably more than was wanted.

A Gentleman—To get 13 tons pressure upon a brick, the wall must be 2,000 feet high.

Mr. Smith, in illustration of his position, mentioned the fact that soon after the building of Waterloo-bridge some third and fourth-rate houses were built only a brick and half thick from a foundation considerably below the level of the bridge approaches, and carried at that thickness to a height of 94 feet, so as to form two houses one above the other, and yet there was no instance of the crushing of the bricks in those buildings, although some parts might have sunk. The weakest description of brick manufactured was the grey-stock, and that brick was quite strong enough for all the purposes for which it was employed. A great deal had also been said with regard to the weight of bricks. He did not think weight was a necessary qualification in a good brick. He considered a brick of 5lbs. weight (which was the average of the grey-stock) a perfect article as respected weight. The disadvantage of having very heavy bricks was the additional weight that had to be carried about before the bricks were placed in the building. This would add to the labour, and consequently to the cost of the building. Moreover, a workman would not be able to go through a day's work of ten hours lifting with one hand a brick of 8lbs. or 9lbs. weight. Whether there was any advantage in weight and density he had yet to learn.

Mr. Henry Doulton had listened with great interest to the two papers which had been read by Mr. Chamberlain, and particularly to the practical observations which had on each occasion followed from Mr. Beart, who so thoroughly understood the subject. He had been struck with the vast improvement that had taken place in the manufacture of bricks since the removal of the duty. The same remark would apply to the manufacture with which he was more especially connected (stone ware) since they had been relieved from the visits of the excise officer; and upon the same ground he apprehended a large field was opened for improvements in bricks of an ornamental character, although that operation might be said more properly to appertain to the potter's art. He had had considerable experience with regard to fire bricks, and he was persuaded that machine-made fire bricks—so far as that manufacture had been carried at present—did not answer so well as hand-made, nor was he aware of any manufacturer of fire bricks employing machinery for that purpose, although he knew several who had tried machines of various kinds, but they had not succeeded. At the same time, he believed the manufacturers generally would be glad to avail themselves of machinery if it could be adapted to their purposes. With regard to density, his experience had been, that fire bricks of great density would not stand so well as those of a more open character. He agreed in the remark of Mr. Beart, that too much importance was attached to the density imparted to machine-made bricks, and he could corroborate the statement of Mr. Beart that the great density of earthenware articles arose more from the manner in which the clay was prepared than from the mode of the manufacture. The better descriptions of pottery made upon the potter's wheel were far more dense than any machine-made brick, except they brought very great hydraulic pressure to bear upon it. The striking fact brought out in the report on the relative strength of different bricks in withstanding crushing power, viz., that of two bricks made of the same material and by the same machine, the hardest burnt withstood double the pressure of the softer brick, showed the importance of vitrification in enabling clay goods to withstand pressure. All the experiments went to confirm this. The Worcestershire brick, that withstood a pressure of upwards of 100 tons, was semi-vitrified; but it would not answer commercially to make bricks of that superior quality. He concurred in the remarks of Mr. Beart that the great object was, to convert the brick works into brick factories, for he had often been struck with the immense space occupied by brick-yards, which led him to the conclusion that it was an operation attended with great waste of space and labour; and he believed the plan sketched out by Mr. Beart would ere long be much more extensively adopted than was at present the case.

Mr. Guilford Molesworth said, the method adopted to crush the bricks, in the experiments detailed by Mr. Chamberlain, was by placing them on the follower of a powerful hydraulic press, and interposing a thin sheet of lead between them and the follower, another sheet of lead being placed above them. A cast-iron plate, so arranged as to adjust itself to the upper surface of the bricks, communicated the pressure to the bricks, so as to produce an uniform pressure over their whole surface, in the event of the upper sides not being exactly in a plane parallel to the top of the press. The surfaces of the bricks, both top and bottom, were carefully faced up with sand, to produce a flat surface and to remove all irregularities. The press used was nine inches in diameter, and the weights were applied at the end of a lever multiplying fifteen times, and acting upon a plunger one inch diameter. Every precaution was used to insure accuracy of result. The weights were suspended with the greatest care, and the lever allowed to sink to its bearing very gradually, to avoid any momentum which might vitiate the experiment. After a full bearing was obtained, the weight remained for a short time before more weight was added. It had been objected that the pressure exerted by a hydraulic press could not be calculated to such a nicety as when the lever alone was used, and that an inaccuracy of $\frac{1}{100}$th of an inch in the dimensions of the ram would produce an incorrect result. Mr. Molesworth agreed partly in this remark, but it should be remembered that the object of these experiments had been to determine the relative, not the absolute, strength of the bricks, and if such an inaccuracy did exist, it would exist equally in all the experiments, but the relative strength would not be affected by it. At the same time, he might observe that the press was a new one; that it was carefully made to the dimensions by Messrs. Cottam and Hallen, who were noted for precision and excellent workmanship, and such care was taken to ensure accuracy in all points, that though the absolute strain determined by these experiments must be considered approximate, he could confidently assert that that approximation was a close one.

Mr. Schwartz expressed an opinion that the strength of a building was not so much dependent upon the bricks as upon the mortar with which they were set, and a proper care in the outer joints of the work. He concurred in the opinion expressed by Mr. Smith, that bricks of great weight were not accompanied by corresponding advantages.

Mr. Beart remarked that he had heard the assertion that they could not profitably make bricks for cornices and such like purposes. He begged to state that at one of his works he manufactured that description of brick by machinery with edges as fine and perfect as in any of the bricks now before them. He had experienced no difficulty in the manufacture of ornamental bricks, and the only addition in price over that of the ordinary description of brick was about 2s. 6d. for the alteration of the mould necessary for the design. He had seen some very beautiful white cornice bricks manufactured at Rugby, which were brought to such perfection as to equal the finest stone-work in appearance.

Mr. T. Scott was surprised that, while all the practical men who had spoken had indicated their knowledge of the fact that drying power was the primary essential in the manufacture of bricks and similar ware, none of them had mentioned the French *calorifère* as adapted to this purpose. It was a scientific and an easily regulated diffuser of heated air, and produced the desired results economically. Mr. Mechi, amongst others, used it for warming the workshops in which his men were employed, and he had told him (Mr. Scott), two years ago, that he could, by its aid, regulate the temperature of those rooms to a nicety. It was adopted by a drain-pipe and brick-manufacturer in Worcester, two or three years ago, to dry his goods, and the result had been most successful; and it was also, about two years since, introduced at some extensive government works, with which he (Mr. Scott) was concerned, and where several millions of drain-pipes had to be manufactured; and after some trouble and expense in adjustment, it now accomplished an amount of drying which could not be done in any other way that he was aware of. He was likewise surprised that Mr. Beart, who had, no doubt, an experience as extensive and varied as any man in this country, should state that the waste heat from a brick or tile kiln was of no value in drying such goods, "because it could not be regulated." Why, at the very works which he (Mr. Scott) had named, the waste heat was used most successfully as an adjunct to the *calorifère*, the smoke being first allowed to go off before the heat was turned under the drying-floors, and there was found to be no difficulty in ascertaining its effects by means of thermometers, and of regulating its action accordingly, by means of slide valves. The goods dried by this process were superior, when burned, to those dried in the open air. He had thought himself justified in stating these facts to the meeting, as he was not aware of any other impediment to an unlimited produce of bricks and drain-pipes from a sufficient bed of clay than the want of an unlimited and sufficiently cheap drying process. Mr. Chamberlain had shown his appreciation of this point by his elaborate reference to it in his paper; but another speaker had, with truth, emphatically reminded them that they must not neglect what nature did for this manufacture by means of sun and air, and which, after all, must continue to be the process of drying generally resorted to, throughout the country, by the numerous smaller makers of bricks and drain-pipes.

Mr. Dowell mentioned that he was abroad in November last, and witnessed a system of drying and burning bricks in a most successful and economical manner, which was now being experimented upon in this country. The cost of burning by the process to which he alluded was only 1s. 3d. per thousand, and the drying and burning were accomplished in twenty-four hours.

The Chairman.—Is the operation a secret?

Mr. Dowell said it was so at present, but in about six weeks' time he believed it would be made public. The process had been patented in this country.

Mr. C. H. Smith would mention, for the benefit of those who took an interest in testing the strength of materials, that Professor Eaton Hodgkinson was at present carrying on a series of experiments at University College, under the authority of government, with an apparatus constructed for the purpose upon the lever principle. He believed the test in that case would be much more accurately defined than was the case with the hydraulic press.

Mr. Chamberlain said he had great pleasure in making a few remarks on the practical discussion which had taken place. The employment of the waste heat of the kilns for drying the green ware was not so irregular as Mr. Beart imagined. There were 24 hours of a low heat when drying off, 48 hours of full heat, 24 while burning, and the first 24 hours cooling, and 24 more hours of a less heat during the completion of the cooling. Now, with this amount of heat, more than sufficient ware could be dried to again fill the kiln, and this at no extra cost. Mr. Beart had alluded to the density of china depending on the contraction of the clay in drying. He must, in this respect, differ from him, as the quality of that ware arose from the thorough vitrification of its particles when subjected to an intense heat. He was much pleased to hear from so practical a man as Mr. Beart, that he agreed in the opinion expressed in the paper that brick manufactorie should be established, and the primitive method of manufacture, now so universal, be abandoned. The pressure sustained by the solid bricks made by his machine, exceeded by 69 tons that borne by the perforated, made from the same clay and by the same machine, and was 104 tons more than a London stock-brick. This most completely refuted the theory of Mr. Clayton in the last discussion, when he said that bricks made from a screw machnie took a circular form, and, if the bricks were minutely examined after burning, they would not be found so sound. Now, this circular form or coils in the clay was, in his opinion, the source of strength; and it was the principle of working the clay in his machine which gave that great strength. The clay was powerfully compressed by the screw, then subjected to further pressure in its passage through the feeding die, and was then in that state in which other machines delivered the finished brick; but in his machine it had to undergo a still further pressure by being again compressed between the four driven rollers, and hence the great strength and density of the bricks produced by it. He could not answer this point last week, as Messrs. Horner and Molesworth had not completed their experiments, and, until yesterday, he was not aware of their great superiority. The perforated brick only sustained one-third the transverse strain of the solid. Now, with these proofs before him, he could venture to state, in the presence of London makers, that in this district of the country the quality of the brick was sacrificed to colour. If he had such bricks in his works as were commonly used in London he could not give them away. The weight of machine-made bricks was not so much more than the hand-made—a London stock-brick was only one-fifth less in weight than a machine brick per cubical contents. Before using them it was necessary to saturate the bricks with water, and the London stock-brick, being very porous, when charged, would be nearly equal in weight with the machine bricks. With the experiments for testing the bricks he had not in any way interfered; he certainly witnessed them, and must bear his testimony to the accuracy and care with which Messrs. Horner and Molesworth carried them out. These gentlemen applied to Prof. Hodgkinson to test the bricks on the table, but that gentleman was so much engaged that he could not undertake it. It had been remarked that bricks of the quality of those made by his machine could not be produced commercially at a profit. He might mention that they were the common bricks from the works of the Earl of Coventry, and were sold at a much lower price than the London bricks, though burnt with coals at 16s. per ton. The argument that the London brick was all that was required, was very fallacious. He imagined there were few gentlemen present, if building a house for themselves, who would not use sound strong bricks in preference to the inferior ware generally supplied, if they could be obtained on equally reasonable terms. The bricks were manufactured by the machine of this superior quality at one-half the cost of labour in hand-making, and hence realised a larger profit to the manufacturer. The quality of the bricks, he had before stated, depended on their density. Mr. Dowell would certainly confer a great boon on the trade if he could introduce a system of drying and burning in 24 hours, but he (Mr. Chamberlain) acknowledged he could not entertain such a proposition. He would refer to Mr. Beart, if, in his experience, bricks could be dried alone in less than 24 hours, much more burnt as well. The clay might be dried, but the rapidity of the process would so fracture the bricks that they would be of very inferior quality.

The thanks of the meeting having been conveyed to Mr. Chamberlain,

The Secretary announced that the Fifth Annual Institutes' Conference would take place on Monday, the 23rd of June, at 12 at noon; the One Hundred and Second Anniversary Dinner at the Crystal Palace on the 24th inst., at 5 p.m.; and the Annual General Meeting on the 25th inst., at 4 p.m.

Home Correspondence.

REMARKS ON MR. CHAMBERLAIN'S PAPER ON BRICKMAKING BY MACHINERY.

Sir,—I beg to thank you for your kindness in sending me the last number of the *Journal of the Society of Arts*, containing the excellent paper on brickmaking by machinery, read by Mr. Chamberlain, on Wednesday evening, which I have perused with great interest, and much admire the candid way in which he has been pleased to speak of those machines which operate upon the clay in a semi-plastic state, as taken from the mine, and produce bricks in a state fit to be placed in the burning kilns immediately on leaving the machine.

In treating of this class of machinery, Mr. Chamberlain justly remarks that, 1st, They have to exert an immense amount of force in order to press the comparatively dry material into the moulds, so as to fill the corners, involving a great waste of motive power, and risk of damage to the machinery. 2nd. That the bricks are rendered imperfect by the expansion of those parts of their surfaces which are first relieved from pressure; and 3rd, That such machines are necessarily large and expensive.

As a rule, these remarks are correct, but had Mr. Chamberlain been acquainted with the principles of the machine which forms the subject of my last patent, he would, I think, have been constrained to admit that there is, at least, one exception to it.

Having, during the last six years, been engaged in a series of most expensive and laborious experiments, in surmounting the difficulties he enumerates, I trust a few remarks from me will not be deemed out of place in your *Journal*, more especially as the arguments on Wednesday evening appear to have been almost exclusively in favour of cutting machines.

The first objection I have succeeded in remedying, by giving to the column of clay, *ab initio*, a less sectional diameter than that of the mould into which it has to be driven, and forcing it, when properly prepared, into a space of a *greater* diameter than that of the screw which forces it; consequently, no "wire-drawing," or rolling out of the column is required, and by forcing this column through the moulding-boxes (which are open throughout) into a "rectum," or waste pipe, of the same shape and diameter as the die, a continuous stream of clay may be maintained for any length of time without occasioning any wasteful consumption of motive power, or undue strain upon machinery. So soon, however, as the moulds, which have a reciprocating action, are put in motion, the bricks are cut out of this column, right and left, the column which is in the waste pipe, and which acts as a safety-valve, being slightly protruded each time the mould becomes full, so that this machine combines, in reality, the principles of cutting and moulding.

The second objection is obviated by planing the bricks, on their mortar surfaces, "in transitu" to their point of delivery.

In reference to the third objection, I will only say that machines, capable of producing from 20 to 60 bricks per minute, fit to be placed in the kilns on leaving the machine, from clay which has not, in many instances, undergone any previous preparation, are supplied at from £150 to £180 each.

These machines have the great advantage of being applicable to every description of clay which is sufficiently dry, and to many from which it would be quite impossible to produce, by the cutting process, a brick fit for the market.

I fear I have trespassed too much upon your space, although I have so imperfectly described my principle, but should it be considered of sufficient importance, I shall be most happy to treat the invention more fully in a subsequent communication, or to demonstrate it before the Society at one of their meetings.

I have, &c.,

J. P. OATES, M.R.C.S.

Erdington, Birmingham,
June 9th, 1856.

ARRESTING FIRES.

Sir,—The suggestion of Mr. Murphy, for arresting fires by the use of salt water, which was printed in No. 185 of the Society's *Journal*, appears to me to be so valuable as to deserve further notice.

Every housewife is familiar with the *fact* that salt sprinkled on blazing coals *stops flame*, and hence its use to "make a clear fire." For the purpose of arresting fires, water saturated with ALUM will be found even superior to where salt is used, and I take the liberty to suggest (on Mr. Murphy's hint) that the tanks of water on her Majesty's Theatre and other buildings be saturated with alum, as, should the unfortunate necessity arise, whatever material the alum water falls upon will be rendered nearly incombustible.

Yours faithfully,
SEPTIMUS PIESSE.

2, New Bond-street.

TONNAGE REGISTRATION.

SIR,—In the *Journal of the Society of Arts* of May 30th I observe a second letter by Mr. Atherton, addressed originally to myself, and published in the *Mechanics' Magazine* of Saturday last. In the next number of that *Magazine* I intend to insert the subjoined remarks upon Mr. Atherton's letter, and I shall feel obliged if you will give place to them in your *Journal* of the 13th, in order that the question may not be left in an incomplete and partial form before your readers. As changes in the system of "tonnage registration" can only be effected by Parliamentary action, it is important that propositions designed to promote such changes should be freely and closely examined, and on that account your Society will, I doubt not, view the present discussion with interest. But for this consideration, I would not request you to transfer the following reply to your pages.

I am, Sir, your obedient servant,
THE EDITOR OF THE
MECHANICS' MAGAZINE.

166, Fleet-street, London, June 9th, 1856.

"In making a few comments on the letter in question, we beg again to assure Mr. Atherton that we entertain a very deep respect for his honesty of purpose, integrity, and capabilities, although we cannot give in our adhesion to all that he has written on Tonnage Registration. Our object in the remarks we have made on this question has been the elucidation and confirmation of truth. We took up Mr. Atherton's Essay in no hostile spirit—quite the contrary; but felt compelled, from our convictions (for which we have a right to claim as much honesty as Mr. Atherton would demand for his), to express our dissent from a considerable portion of it.

"Comparing the letter which we last week inserted with that Essay, we cannot help congratulating Mr. Atherton upon the manifest improvement which has taken place in his opinions, although they are still far from being faultless. We have, however, reason to complain of his mode of expressing himself on several occasions; probably the meaning conveyed to others is not that which was intended, but the effect is the same, whether intended or not. For instance, we are told that we are "*constrained* to acknowledge, and at the same time palliate the insufficiency of the law of 1854." Now, what is it that 'constrains' us to offer any opinion? Mr. Atherton's words would imply that we have put ourselves into the attitude of an advocate, and that we are *unwilling* to make any admission that might seem to tell for him. This is a gratuitously assumed conclusion on his part; and if he wishes credit for honesty—which we are by no means inclined to refuse—we may at least claim equal credit for it ourselves.

"Mr. Atherton complains that we, in common with many others, have misunderstood, and so misstated, the purpose of his paper, and have consequently attributed to him conclusions which he disavows. If this be so, he has no one to thank but himself for such misconceptions. For instance, it appears now that he had no fault to find with 'internal roomage' as one element of registration, and still less with the '*mode*' of measurement which he regards as a mere 'question of detail;' although he does entertain an opinion with regard to the relative merits of Mr. Peake's and Sterling's rule, about which we shall have something to say hereafter. Our notion of what Mr. Atherton meant was derived from such paragraphs as the following:—'In the first place, let us inquire what is the meaning of the term *tonnage*, as made use of in shipping registration under the now existing law, namely, the Mercantile Shipping Act of 1854? what matter of fact or measurable realities does the term tonnage signify? has the *tonnage* of a ship any specific relation either to the displacement of the ship or the nett tons weight of cargo the ship will carry, or the quantity of cargo a ship will hold? does the registered *tonnage* correctly answer any purpose as the base of calculation in commerce, *or as preventing fiscal* imposition? does it equitably constitute the base of building contracts? or answer any useful purpose in scientific inquiry, as affording elementary data available for determining the relative locomotive merits of ships? Finally, does the registration of *tonnage*, under the existing law, afford any information whereby cupidity and recklessness in the loading of ships can be officially exposed or checked in a manner conducive to the safety of property and life? Such are the points which we purpose inquiring into; and if the present system of tonnage registration dose not fulfil these requirements, it is purposed to submit to the consideration of the Society of Arts such suggestions as may conduce to the attainment of these objects.'

"We need scarcely observe that the paper consists in proving that the 'present system' does NOT fulfil these requirements, and suggestions are offered accordingly. As regards the *mode* of measurement, again. which we are now told is a mere matter of detail. our readers shall hear what Mr. Atherton has to say in the following passage. almost before he has fairly entered on his subject, and judge whether we have misstated him. 'Under this Act of 1854, a system of tonnage admeasurement, based on internal capacity, but reduced by a factor (divisor 100), in order that the aggregate of tonnage, as measured by this new law, might correspond with the aggregate, if measured by the old law, has now become the law of the land; and *although* this commission commenced its labours under the avowed and recorded declaration, 'that it is desirable to establish an easy practical mode of admeasurement,' the specification merely of the outline of the system of admeasurement, as prescribed by the Bill of 1854, occupies no less than ten clauses in the Act; and the detail of working out the calculations, to be properly understood and not done by rote, demands a course of laborious mathematical study. This system being merely the application of mathematical routine to the curvature of bodies. its accuracy may be admitted; but the prescribed detail of instructions to meet various sises of ships and various peculiarities of construction have been made so multifarious as to complicate the application of the system, and to render the practical operation whereby the results are obtained a mystery, unintelligible to everybody excepting those who make it a professional study.'

"Pretty plain speaking this; and yet Mr. Atherton is astonished that Mr. Moorsom (not we) designated his paper a 'condemnatory harangue.'

"Again:—'The inveteracy of blind habit cannot be better illustrated than by the fact that the old rule for calculating tonnage, without reference either to depth of hold or draught of water. withstood the declared condemnation of several successive Parliamentary commissions, and continues to be pertinaciously made use of to regulate ship-building contracts. and the purchasing of ships in mercantile dealings, and even by Government authorities, though legally superseded in 1854 by Act 5 and 6 William IV., c. 56, which thus twenty years ago prescribed and legalised a totally new system of tonnage admeasurement based on ordinates, as hereinbefore referred to, which system failed to be popularly adopted on account of its complication; but nevertheless a far more complicated extension of the same system has now been introduced by the Merchant Shipping Bill of 1854. . . . Popular education has doubtless of late years made great progress; but still we have scarcely arrived at such a state of proficiency as to render it advisable that our tonnage admeasurement, so constantly put in requisition by every merchant, should be the solution of the mathematical problem for the *reduction of parallelopipedons by rectangular co-ordinates*. Were the new measurement of 1854 honestly called by this its proper name, it would not be listened to for one moment; the very name would expose it; but, instead of being thus designated, it is called Sterling's simple and easy system of admeasurement. Undoubtedly Sterling's reduction of parallelopipedons by rectangular co-ordinates. like the calculation of eclipses, may be simple and easy to those who perfectly understand it, but a mystery to those who do not, and very likely to be bungled by those who attempt to apply it in ignorance of the principles involved.'

"Such was Mr. Atherton's 'declared condemnation' of Sterling's rule on the 16th of January. On the 27th of May the same gentleman considers 'the *mode* of measurement a question of detail.' He has 'no desire to depreciate Sterling's rule,' and is surprised at our directing so much of our readers' attention to it. We congratulate him on his change of opinion, but we really must demur to his including this among the 'gratuitously assumed conclusions' which it appears we have been pleased to represent as the purport of his paper, and have so misstated his case.

"As regards his imputed attack on the shipping interests, we have already expressed our opinion that he intended no serious charge against them. He now denies that his words are capable of any such construction, and we do not doubt his sincerity in this declaration. Mr. Atherton, however, must have far less experience in the ways of the world than we give him credit for, if he is unaware that far more serious damage can be done to a reputation by an apt introduction of it into the company of characters about which there can be no mistake, than by any direct imputation. And we must say, that when, *a propos* to the subject of registration, *boroughmongering*, opposition to free trade, fraudulent declarations of dividends, to say nothing of the imputed corrupt resistance to reform by the professions of law, physic, and divinity, are brought upon the *tapis*, the shipping interests, who are not conscious of their imputed shortcoming, naturally feel aggrieved at being placed in such questionable, or rather unquestionable company. It is more in what is implied than in what is decidedly said, that the 'insult' was felt to consist. However, with the ample explanations of Mr. Atherton, the parties concerned would be unreasonable not to be satisfied.

"Our remarks, be it observed, went only to the point that the necessity and the advantage to the public of a change of registration had not been established on such reasonable grounds as to afford any parallel between the shipping interests and other notoriously corrupt bodies declining to petition for their own reform. But is it not assumed that this necessity and advantage have been incontestably established in the whole paragraph complained of—especially in the peroration?—'What right or reason, then, have we to expect that the shipping interests will voluntarily petition the legislature for an effective system of registration, *throwing open the mysteries of their craft with a view to the public good?*'

"Then, again, Mr. Atherton hardly states the case fairly, when, in disavowing the conclusions which have been erroneously attributed to him, he says, 'For instance, by my paper I did not object to internal roomage as one element of tonnage registration; but I upheld it as indispensable to a complete system of registration.'

"To state the case fairly, Mr. Atherton ought to have told us the *relative importance* of the registration of the 'internal roomage,' as at present by law established, and as it would be in accordance with his own suggestions. By the law of 1854, the internal roomage, divided by 100, constitutes the tonnage of the ship on which 'harbour dues, pilotage, light dues, and the like are to be assessed.' According to the proposed system, the registration of 'internal roomage' is of very minor importance, and might be entirely omitted with little or no inconvenience. It would scarcely be missed.' Mr. Atherton suggests in his paper that the 'builders' measurement, which is also to indicate the size of the ship on which the various dues are to be assessed, should be determined by taking the product of the external length and breadth as measured at the regulation deep draught-line water-line multiplied by the *internal* depth of the hold, and divided by 100,' corrected by a suitable factor, 'according as the intended ship may be proposed to be built with full lines burdensome for cargo, or finer lines more adapted to speed.' The *main* issue, therefore, is necessarily raised between these two measurements—for *fiscal* purposes; and as the greater part of Mr. Atherton's paper is directed against the established measurement *as suitable for this purpose*, we do not think that gentleman has much reason to complain of 'gratuitously assumed conclusions' on our part, or of the term 'condemnatory harangue' against the Merchant Shipping Law of 1854, applied to his paper by Mr. Moorsom.

"Any one perusing his letter in our last number, and not well acquainted with his original paper of January 16, would go away with the impression that he left internal measurement to perform pretty much the same functions as at present, only suggesting other matters 'in addition.' Whereas the real question is the much-vexed question between *external* and *internal* measurement as the basis for levying light and other dues!

"By-the-bye, as Mr. Atherton is so exacting in his requirement that the word tonnage, as made use of in shipping registration (and he will scarcely deny that levying dues is one of its principal uses), should 'signify' some 'matter of fact or measurable *reality*;' what 'matter of fact or measurable reality,' we may, in our turn, inquire, does the proposed builders' measurement represent, 'having *two external* elements and one *internal*?'

"As for the *admissions* which it seems we have made, and of which Mr. Atherton certainly is not inclined to throw away the benefit, we really went further than he states; we allowed that the present mode of measurement was only the *second best* resource of the Government, who had been foiled in their attempt to legalise an equitable system of external measurement. They fall, however, very far short of an admission of all the 'grounds on which 'Coryphæus the agitator based his condemnatory harangue.'' That worthy gentleman must have strangely forgotten his own paper—or must give credit to others for a very short memory—or he would tell our readers that the assumed encouragement to shipowners to dangerously overload their vessels held out by the present registration was one only among many other grounds on which his 'condemnatory harangue' was based. We have, for instance, first of all, the 'complication' of the rule itself, which was stated to be unintelligible to all but professional persons, and such as to render its application abortive; this, too, subsequently enlarged upon as we have already shown. Next, we had the 'assumed' misapplication' of the term 'tonnage' as applied to 'roomage,' and not to 'weight' burden. Thirdly, the assumed insufficiency of the guarantee given by the new rule, or 'inducement to builders tending to improvement in the form or build of shipping.' Fourthly, its incompetency to afford data for the comparison of the *locomotive* merits of ships—to say nothing of an 'assumed' ambiguity in the term tonnage itself, as defined by law, which we showed to be a mere creation of Mr. Atherton's brain. All these points were jointly and severally, and 'verbosely,' aye, verbosely, descanted on, as most cogent reasons for substituting Mr. Atherton's propositions for the present law, which, if we are not egregiously mistaken, was the true purport of his paper. He now, however, limits his observations to one only of these points, viz., the encouragement given to the dangerous overloading of ships; on which ground, in consequence of our admissions, he thinks himself safe.

"He joins issue with us on our statement that a vessel of 1,000 registered tonnage may safely be considered by the owner to be capable of bearing 1,000 tons weight. This he answers by an 'assertion,' of the truth of which he gives us no means of judging, that the safe loading of two ships of the same nominal tonnage may vary in the proportion of 30 to 5, and that while one vessel of 1,000 tons may safely carry 1,500 tons weight of cargo, and in addition 1,500 tons by measurement of light cargo—in all 3,000 tons weight—another may safely carry only 500 tons weight. We may well let this assertion go for what it is worth; for our part, until we have some data in its favour to rely upon, we withhold our assent.

"A vessel of 1,000 registered tonnage has an *internal* capacity of 100,000 cubic feet. 1,500 *tons weight* of cargo represents a displacement of 52,200 cubic feet of water; and 15,000 tons of light cargo at 40 feet to the ton, represents a displacement also of 52,500 cubic feet; so that the whole displacement of such a vessel between the light and load draughts is 105,000 cubic feet—5,000 feet more than its internal measurement. To this we must make a considerable addition for the light displacement. The vessel in question must, therefore, have an *enormous difference* between its external and internal measurement—an unheard-of thickness of scantling to carry so much weight, and that too, at a safe distance below the deck! The other poor ship, which may carry 500 tons *weight*, is limited to a difference of displacement of 17,500 cubic feet; and yet their internal space is the same! *Credat Judæus*! Now, we have asserted that a ship of 1,000 nominal tonnage may be fairly reckoned upon for carrying 1,000 *tons weight* of goods. This is allowing only 35,000 cubic feet of sea-water for the displacement of such a vessel between the load and light draughts! This is so much within bounds that we might safely have ventured upon a higher figure.

"Mr. Atherton has made up his mind, however—in spite of the admissions of all men practically interested in this matter, that the present law does afford a fair basis for levying tolls—that this shall only be done at the price of safety. Nothing, then, will serve him but to represent our 'ships as sunk or water-logged, deck awash, full, it may be, of dead men's bones,' in order to secure equity in levying tolls—a precious condition of things indeed! which may be applicable enough for his model ship of 1000 nominal, but 3000 real tonnage, but which we utterly repudiate.

"It does not seem to have struck Mr. Atherton that possibly without sinking ships, there may be a *tolerably fair* proportion between the whole internal measurement and the displacement when fully loaded, not varying for different ships so much as 5 or even 2½ per cent.—the nearest approximation to correctness which he himself aims at.

"Now, with regard to fixing the load water-line, we are told that hundreds of ships are instanced by Fincham, in which the limit of draught or load-line, as proposed by the constructor, is specified and recorded in feet and inches as the contemplated limit of loading. Granted. A large proportion of these ships, unless our memory fails us, are vessels of war. Now we speak under correction, for we cannot expect to have the same information on this point as a Government officer, whose duties necessarily make him acquainted with these matters; but we are under the impression that the fixing of the load water-line is necessary in ships of war, not so much to create a limit for the safe loading as to keep the batteries at a proper distance above the water. We have heard it whispered—we still speak under correction—that it was not at all an uncommon thing, in the reign of the late surveyor of the navy, to hear of vessels constructed for a definite load-draught being immersed several feet beyond, and yet no danger, or suspicion of danger, to the *safety* of the ship resulted.

"In the case of merchant vessels, the constructor doubtless would consider that the ship, if immersed only as far as his proposed deep-draught water-line, would display her good qualities in the highest degree; but we question whether he would presume to say that it would be *dangerous* to load her more deeply. Indeed, we question whether it would be an easy matter to find a constructor who would take on his shoulders the responsibility of fixing such a limit. At all events we believe we are right in asserting that no such quality is now attached to the constructor's load water-line. That the *difficulty* (we do not say impossibility) of fixing a limit to the safe immersion of ships is real, and not entirely attributable to 'the cupidity of ship-owners and ship-charterers,' Mr. Atherton might have satisfied himself by the reflection, that, after all his inquiry and research, he is unable to suggest any nearer limit than one-*fourth*, or one-*fifth*, or one-*sixth* of the beam below the deck. We are left in a state of uncertainty whether in all cases the distance is proposed to be some *one* of these proportions, to be settled by 'consultative deliberation,' or whether all these are to be used according to circumstances. One would imagine, however, that a *long* ship, with comparatively small breadth, would, for safety, require the *water*-line at a greater distance below the deck than a shorter ship with a fuller beam. Mr. Atherton's suggestion, if adopted, would give exactly the opposite result.

"We repeat, we only instance this to show how difficult it must be to fix this line, since such is the only suggestion that has occurred to the mind of Mr. Atherton, who is giving anxious attention to the whole question.

"As regards the operation of the new law, Mr. Atherton has not touched the real point at issue. We maintain that the duty of government is to levy its tolls on vessels fairly, without giving an undue preference to any particular type of build. This is unquestionably done by the new system of basing these payments on the *actual internal measurement*. Whether a ship is built 'with full lines burdensome for cargo, or with finer lines more adapted for speed," its *exact* internal measurement is taken as the basis of levying the payments; and a builder or owner is therefore not obliged to think of anything but the form most suitable for his own purposes, in order to meet the requirements of the law. This surely is as much as can fairly be demanded.

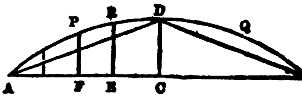
"We have now briefly discussed the principal points brought forward in Mr. Atherton's letter occasioned by our review; and again we congratulate him—on comparison of this with his former 'recorded' view—on the important modifications which have taken place in his opinion, which leave us room to hope that he may ultimately return to a sound state of mind on tonnage admeasurement.

"Our readers will remember how anxious Mr. Atherton was, that our note on tonnage measurement should be republished with all the corrections which had unfortunately been rendered necessary by its accidental admission without a final editorial revision. We, and probably our readers, expected some strictures on it. We are, however, gratified to find, that Mr. Atherton can find nothing to say against it. He qualifies this tacit approbation, however, by a comparison of it with 'Mr. Peake' system,' which we are told deserves the preference, on the score of superior applicability and facility of being mentally understood by the operator, and that it includes a closely approximate measurement of the curved spaces, whether convex or concave; whereas, by Sterling's rule, 'no notice whatever is taken of the curved portions above referred to; Peake's system is therefore the more correct of the two.'

"Now we do most sincerely trust that Mr. Atherton has formed his judgment on other questions brought prominently before the public in his paper, and his subsequent additions to i on more reliable data than he has brought to bear on this subject. We assert—and are ready to prove, if necessary—that Sterling's rule is applicable to the measurement of the curved spaces, whether convex or concave, by which the real form of a ship between the extremities of the ordinates of measurement differs from a straight line: and that, taking notice of these portions of the ship is by no means a peculiarity of 'Mr Peake's system.' We presume that the curve of sections, as explained in Mr. Peake's little work in Weale's Rudimentary Series, published in 1849, is that alluded to. At all events, we do not know of any other publication of his which contains a more elaborate exposition of his 'system,' or a different 'system.' For a complete elucidation of this mode of measurement, we refer our readers to p. 15 of the little work referred to.

"After the statements of Mr. Atherton, our readers will be surprised to hear that Mr. Peake divides the length of his ship into a definite number of *equal* parts, as usual, and takes the vertical sections at each of the points of the division, *the areas of which he calculates strictly in accordance with the received rule*. It is here that the divergence from the usual method takes place. He takes a base line, which he lays down to a certain scale, to denote the length of the ship, and at each point of division sets off lines at right angles to this to a fixed scale, proportional to, and therefore representative of, the areas; and through the extremities of these ordinates he draws a curve, which is the curve of sections. Now, with all this, we find no fault whatever. On the contrary, the representation of the solid contents of the ship by means of this curve is attended with several advantages. But the method by which that measurement is effected cannot so unreservedly meet with our approbation. The length being divided into two equal parts, and the ordinate to the curve drawn at the middle point, by joining the extremity of this ordinate with each extremity of the length, the figure is divided into two equal triangles, and two areas contained between the curve of sections and the chords before drawn. These two curvilinear areas are considered as portions of common parabolas, and so the calculation is effected.

According to Sterling's rule, the curves drawn through the extremities of each of three consecutive ordinates is a parabola, which evidently gives a closer approximation than Mr. Peake's rule. Thus, if A B be the length, C its middle point, and C D proportionate to the area of the section at C, A P D Q B the curve of sections, the area A B D is divided by A D, B D, into two equal triangles, A C D, B C D, and two curvilinear areas, A P D, D Q B; these latter are supposed to be parabolas Now, it is evident that if A C be of considerable length, this supposition cannot be made without sensible error. If, however, E R, F P be two ordinates of the curve or 'representative areas' at moderate equal distances, C E, E F, P R D might be taken, without sensible error, to be a parabola; and so for other portions. Peake's method of curves of sections, so far as any peculiarity in the measurement goes, is therefore decidedly *less correct* than Sterling's rule. The independent measurement of the appendages, as they are called, *i.e.*, those portions of the vessel (as part of the stem, stern-post, and keel) which are not bounded by curves, belongs to no rule in particular



"Unless, therefore, we are grievously misinformed with respect to Mr. Peake's curve of sections, nothing can be more opposite to the truth than Mr. Atherton's ascription to the measurements made by means of it, as proposed by Mr. Peake, of the advantages of superior accuracy, applicability, and intelligibility. On the contrary, when the operator has once become familiar with the mode of calculating an area, (which he has to do for all the sectional areas on Mr. Peake's method), all he has to do by Sterling's rule, is to apply this same method for the summation of the areas to obtain the cubic contents; whereas Mr. Peake requires him to lay off the representative areas accurately to a scale, to draw a fair curve through them, and then to obtain the greatest distance between the two chords and the curve by trial; and all this to result in a measurement decidedly less accurate than would be obtained by following the usual rule.

"If we are mistaken in Mr. Peake's method, we shall be glad to have our error pointed out; but this is certainly what we gather from his little book in Weale's Series."—(*Mechanics' Magazine, June 14th*, 1856.)

PLAN FOR INTRODUCING DECIMAL COINS INTO OUR MONETARY SYSTEM.

Sir,—Permit me to occupy a short space in the *Journal*, to detail a practical plan for introducing decimal coins into our monetary system.

The difficulty which has to be encountered is, that one penny, or the 240th part of a pound, cannot be converted into a decimal fraction, and unless some system be adopted by which our present coins shall bear a definite relation to decimal coins, decimals must remain a bugbear to the million, and their use be unpopular, if not almost impossible, in practice.

The thought which has occurred to my mind, is to construct our decimal and present systems in definite relations, which shall be evident to the mind through the medium of the senses, so that by throwing two masses of coins upon the table, they may be sorted into the decimal and ordinary systems, and one may be rendered exactly equal to the other.

The decimal coinage might consist of the pound, the florin, the decat, and the mil.

The penny, however, cannot possibly bear any relation to this coinage, and we cannot afford to neglect the consideration of this coin, as probably 2,000 tons—and possibly 6,000 tons—of copper are in circulation over the country.

To meet this difficulty, a set of small copper coins should be issued, called the mite, half-mite, and quarter-mite; the mite having the value of the 1-6th of a mil. A penny would be equal to four mil and one mite, the halfpenny to two mils and half a mite, and the farthing to one mil and a quarter-mite.

By the conversion of our present money into mites, the untaught could always tangibly satisfy themselves of their mutual relations, and that by dividing the number of mites by six the result would be in decimal coins,

This mode of dealing with the question—which is applicable to weights and measures as well as money, has been forced upon my mind upon psychological grounds, based upon the properties of matter on the one hand, the powers of the mind on the other. In support of it I would refer to the statements of Mr. Bidder, the great mental calculator, who tells us that he satisfied himself of the properties of numbers through the medium of the senses, and that he made the multiplication table for himself by grouping sets of objects and counting them, thus demonstrating to his own mind that the multiplication table was an an absolute fact of universal application.

I remain, sir, your obedient servant,

ALFRED SMEE.

Bank of England, June 10, 1856.

Miscellanea.

The Royal Society and the Government.—At a special meeting of the Royal Society, held on the 3rd inst., the following resolution was passed, on the motion of Sir Benjamin Brodie, seconded by Professor Bell:—"That the Council be authorised to accept and carry out the proposal of the Government, as to the occupation of Burlington-house, on the understanding that the hall, which it is proposed to construct in the west wing, and which is to contain the portraits belonging to the Royal Society, shall be placed in the custody of the Royal Society, subject to the free use of it by the senate of the University of London at all times at which it may be required for their examinations and public meetings." The library of the Royal Society now comprises 45,000 volumes. The Linnean Society and the Chemical Society will also have accommodation given to them in Burlington-house.

The Schools of Art and the Government Department of Science and Art.—The registrar, Mr. Norman Macleod, has had printed a list of the Schools of Art throughout the United Kingdom, in connection with the Department of Science and Art, completed to May, 1856. From this list the following abstract may be given:—Established as Schools of Design, between 1841 and 1852, nineteen local schools. Established as Schools of Art, since 1852, when the department was constituted,—in 1852, two schools; 1853, fourteen schools; 1854, fourteen schools; 1855, two schools; 1856, four schools—thirty-six schools: total, fifty-five schools; including the nine London district schools, sixty-four schools. Number of persons under art instruction in public schools, 18,198; in central schools, 9,041: grand total, 27,239 persons.

Experiments with Cast-Iron.—The interesting fact is developed by experiments of the U.S. Ordnance Department, that iron, by repeated fusion, up to a certain number of times, is thereby greatly improved in strength. Guns cast solidly, and those cast hollow, through which latter water was made to circulate after casting, showed an astonishing difference in their relative strength, the difference being in favour of the hollow-cast gun, which is attributed to the method of cooling, the solid gun, contracting from the outside, exerting a strain upon the arrangement of the particles of the metal in the same direction as the strain of the discharges. The experiments also showed that old castings are a great deal stronger than new: 8-inch guns, proved 30 days after being cast solid, stood about 72 charges; 34 days, 84 charges; 100 days, 731 charges; and 6 years, 2,582 charges. This phenomenon is accounted for by supposing that the particles strained in the cooling re-adjust themselves in the course of time to their new position, and become free, or nearly so.—*New York Paper.*

MEETINGS FOR THE ENSUING WEEK.

Mon. Architects, 8.
Chemical, 8 (last meeting of session), 1, Professor Abel, "On the Composition of some Foreign Varieties of Iron." 2, Mr. J. L. Wheeler, "On a New Carbon Battery."
Statistical, 8, 1, Renewed Discussion on Mr. Kendrik's paper "On the Loss sustained by Government in granting Annuities." 2, Dr. Samuel Fenwick, "On the Effects of Overcrowding and Want of Ventilation on Cholera."
Tues. Linnæan, 8.
Wed. Geological, 8, 1, Capt. Spratt, "On the Geology of Varna and its Vicinity." 2, Mr. J. Prestwich, "On the Correlation of the Middle Eocene Tertiaries of England, France, and Belgium."
Thurs. Antiquaries, 8.
Royal, 8½.
Sat. Asiatic, 2.
Royal Botanic, 3¾.
Asiatic, 8½, Lt.-Col. Sir H. C. Rawlinson, "On the Chaldeans."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 5th June, 1856.

ar. No.

228. Foreign Legions—Copy of Conventions, &c.
235. Petty Sessions—Return.
242. Lunatics—Returns.
251. Music in Kensington Gardens—Copy of Correspondence.

Sessions 1854-55.

522. Titles, Contents, and Indexes to the Sessional Printed Papers.

Delivered on 6th June, 1856.

207. Proprietors (Scotland)—Returns.
215. Public Accounts (Audit Office)—Return.
160. Bills—Dissenters' Marriages (as amended in Committee, and as second and third Re-commitment).
161. Bills—Grand Juries.
162. Bills—Procedure before Justices (Scotland).

Delivered on 7th and 9th June, 1856.

228. Foreign Legions—Copy of Conventions, &c.
256. Railway and Canal Bills—3rd Report from General Committee.

190. Silver and Gold Wares—Report and Evidence.
203. Ramsgate Harbour—Copy of Sir W. Cubitt's Report.
159. Bills—Scientific and Literary Societies (amended).
163. Bills—Aldershot Camp (as amended by the Select Committee).
164. Bills—Oxford University.
165. Bills—National Gallery Site.
166. Bills—Insurance on Lives (Abatement of Income Tax)—Continuance.
167. Peace Preservation (Ireland).
Italy—Correspondence with Sardinia.
United States (Recruiting)—Papers.
Births, Deaths, and Marriages—17th Report of the Registrar General.

Delivered on 10*th June*, 1856.

219. Geological Survey—Return.
247. Indian Department (Canada)—Correspondenc.
248. Museum of Practical Geology—Correspondence.
244. Transportation—1st Report from the Committee.
Costa Rica—Correspondence with the late Mr. Wallerstein.
Indian Law Commission—3rd Report.

Delivered on 11*th June*, 1856.

263. Sound Dues—Return
245. East India—Copy of a Minute by the Marquis of Dalhousie.
265. Capital Punishment (Colonies)—Return.
Indian Law Commission—4th Report.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette June* 6*th*, 1856.]

Dated 23*rd January*, 1856.

461. John Gedge, 4, Wellington-street South, Strand—Improvements in preparing and combining metallic substances for producing colours, and in manufacturing the same. (A communication.)
462. James Edward Boyd, Hither-green, Lewisham—Improvements in "scythes."

Dated 9*th May*, 1856.

1098. William Edward Wiley, 34, Great Hampton-street, Birmingham—Improvements in the manufacture of pens and penholders.
1104. Frederick Richard Laurence, Southampton-street—Improvement in the manufacture of shirt collars and wristbands.

Dated 14*th May*, 1856.

1139. Gustavus Palmer Harding, Kingsland—Improvement in the manufacture of cloth bonnets.

Dated 16*th May*, 1856.

1159. William Thistlethwaite, 2, Verulam-buildings, Gray's-inn—Improvements in photography. (A communication.)
1161. William Harker, Victoria Mill, Bowley, Bradford—Improvements in giving motion to rotating shuttle boxes of power looms.
1163. Edmund Eaborn and Matthew Robinson, Clement-street, Birmingham—Improvements in machinery for grinding or reducing sugar.
1165. James Mellor, Gorton, near Manchester—Improvements in grates or grids, applicable to sewers, drains, and other similar purposes.

Dated 17*th May*, 1856.

1167. David Curwood, George-street, Grosvenor-square—Improved apparatus for facilitating the cleaning of knives and forks.
1169. Alfred Vincent Newton, 66, Chancery-lane—Improvements in machinery for forging or pointing wrought nails, spikes, and other four-sided articles. (A communication.)
1171. Louis Cornides, 4, Trafalgar-square—Improvements in ornamental window blinds, and such like transparent decorations.
1173. John Hynam, 6 and 7, Princes-square, Wilson-street, Finsbury—Improvement in the manufacture of instantaneous lights when of paper or cotton.
1175. Richard Knight, Foster-lane—Improvements in apparatus for ærating liquids.
1177. Lieutenant-Colonel Charles Carroll Tevis, Paris—Improved revolver.

Dated 19*th May*, 1856.

1179. John Wilkes, Thomas Wilkes, and Gilbert Wilkes, Birmingham—Improved manufacture of rollers or cylinders for printing fabrics.
1181. John Leakey Bowhay, Modbury—Improvements in drills for sowing seeds and distributing manure or water.
1183. Moses Haym Picciotto, 8, Crosby-square—Improvements in preparing flax, hemp, and other similar fibrous materials.
1185. John Wilkes, Thomas Wilkes, and Gilbert Wilkes, Birmingham—Improved manufacture of rollers or cylinders for printing fabrics.

Dated 20*th May*, 1856.

1186. William Fowler and William McCollin, Kingston-upon-Hull—Improvements in portable steam-engines, applicable to agricultural and other similar purposes.
1187. William Maugham, Ifield-terrace, Surrey—Improvement in rendering wood fire-proof.
1189. William Maugham, Ifield-terrace, Surrey—Improvement in rendering cotton and other fabrics and paper uninflammable.
1190. Richard Maxwell, 4, Carlton-terrace, North Brixton—Improvements in the construction of taps for drawing off liquids.
1191. James Anning Gollop, 74, Lower Sloane-street, Chelsea—Improved method of excluding dust, water, air, and other extraneous matters from doors, windows, glass, show cases, and such like constructions.
1192. Samuel Rogers Toms, 3, Church-villas, Croydon—Improvements in gloves.
1193. William Cardwell McBride, Armagh—Improvements in machinery for scutching flax and other vegetable fibrous substances.
1194. Alfred Vincent Newton, 66, Chancery-lane—Improved mode of preparing the double chlorides of aluminium and sodium, and aluminium and potassium. (A communication.)
1195. William Edward Newton, 66, Chancery-lane—Improvements in the process of manufacturing oil from seeds, and in the machinery and apparatus to be used therein. (A communication.)
1196. Alfred Vincent Newton, 66, Chancery-lane—Improved rotary pump. (A communication.)

Dated 21*st May*, 1856.

1197. Joseph Henry Reynell de Castro, Manchester—Improved method of propelling railway or other carriages up inclines. (A communication.)
1198. David Shaw, Gee-cross, Chester—Improvements in looms and apparatus employed therewith for weaving.
1200. John Perron, 53, Buddesland-street, Hoxton New-town—Improvements in ornamenting surfaces of wood, ivory, bone, and such like substances.
1201. Alexandre Henri Dufresne, 39, Rue de l'Echiquier, Paris—Improved process of gilding and ornamenting steel and other metals.
1202. John Cope, Birmingham—Improvement or improvements in the manufacture of buttons made of pearl or other shell, ivory, bone, or wood.
1203. Manoah Bower and John Barwell, Birmingham—Improved method of joining the parts of metallic and other bedsteads and other articles of furniture.
1204. Henry Medlock, 20, Great Marlborough-street—Improvements in the manufacture of glass, enamels, and other vitrified substances.
1205. James Holdin and William John Dorning, Manchester—Improvements in bouking, bleaching, washing, and cleansing textile fabrics and materials. (Partly a communication.)
1206. Alexander Allan, Perth, and Thomas Hunt, Crewe—Improvements in the construction of locomotive and other steam engines and carriages, and in the rolling stock of railways.
1207. George Heron, South-street, Newcastle-on-Tyne—Improvements in machinery or apparatus for raising, lowering, moving, or transporting heavy bodies.
1208. Rudolph Hermann Schwabe, Glasgow—Improvements in the manufacture or production of ornamental fabrics.
1209. Macleroy Neilson, Thorn Mill, Renfrew, N.B.—Improvements in the treatment, preparation, or finishing of yarns or threads.
1210. Edward Greenlees, Glasgow—Improvements in the treatment and preparation or manufacture of textile and pulpy materials.
1211. Charles de Jongh, Lautenbach, near Guebwiller, France——Improved method of separating and assorting combed fibres of different lengths.
1212. Thomas Lawrence, Birmingham—Improvements in machinery to be used for grinding and polishing gun barrels, swords, matchets, bayonets, scythes, fire irons, and other articles similar in transverse section to any of those above named.
1213. Edward Hammond Bentall, Heybridge, Essex—Improved machinery for crushing or splitting grain or seeds. (A communication.)
1214. William Edward Newton, 66, Chancery-lane—Improvements in machinery for spinning or twisting fibrous substances. (A communication.)
1215. William Henry Aston and Samuel Hopkinson, Zetland Mill, Huddersfield—Improvements in steam-boiler furnaces and apparatus employed for supplying water to steam-boilers.
1216. William Joseph Curtis, 1, Sebbon-street, Islington—Improvements in the manufacture of iron railway wheels.

Dated 22*nd May*, 1856.

1217. William Galloway and John Galloway, Manchester—Improvements in steam boilers.
1218. Alexandre Hubert, Capt. in the Navy, Bordeaux—Improved apparatus for ventilating ships or vessels.
1219. John Charles Pearce, Bowling Iron Works, near Bradford—Improvements in apparatus for generating and economising steam.
1220. William Richelieu Hodges, Manchester—Improvements in machinery or apparatus for manufacturing loop-pile fabrics. (A communication.)
1222. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in clock-work, part of these improvements being applicable to other regulating purposes. (A communication.)
1223. Job Cutler, Sparkbrook, Birmingham—Improvements in the manufacture of metallic pipes or tubes to be used for various purposes.

1225. Germain Barruel, 24, Rue Hautefeuille, Paris—Improvements in treating cotton seed.
1226. Robert Bell, 93, Glassford street, Glasgow—Improvement in the manufacture or production of ornamental fabrics.
1227. Charles Dewick, senr., Stanley-street, Leicester—Improvements in machines, generally called "rib frame or rib machine," for producing fancy hosiery.
1228. James Howard, Bedford, and George Williams Baker, Woburn—Improvements in machinery or apparatus applicable to the tilling of land.

Dated 23rd *May*, 1856.

1229. Thomas Dawson Russum, Tipton—Improved brake for steam engines and other motive power engines.
1230. Samuel Berrisford, Portwood, near Stockport, and Enoch Wilkinson, Oldham—Improvements in looms for weaving.
1231. John Gedge, 4, Wellington-street South, Strand—Improved gridiron. (A communication.)
1232. John Gedge, 4, Wellington-street South, Strand—Improvements in looms. (A communication.)
1233. John Gedge, 4, Wellington-street South, Strand—Improvements in machinery or apparatus for winding threads. (A communication.)
1234. John Gedge, 4, Wellington-street South, Strand—Improvements in obtaining a material used in dyeing. (A communication.)
1236. John Gedge, 4, Wellington-street South, Strand—Improvements in machinery or apparatus for the manufacture of billiard cues or similar articles. (A communication.)
1237. John Gedge, 4, Wellington-street South, Strand—Improvements in the application of distillation to gas from the furnaces of steam engines. (A communication.)
1238. George Bell Galloway, 42, Basinghall street—Improvements in the furnaces of marine boilers, and in the construction of steam vessels.
1239. Thomas Herbert and Edward Whitaker, Nottingham—Improvement in the manufacture of warp lace fabrics.
1240. John Dixon, High Bridge, Newcastle-upon-Tyne—Improvements in apparatus for measuring water and other liquids.
1241. Frederick Peter Dimpfel, Philadelphia—Improvements in the construction of screw nuts for axle boxes, and other purposes. (A communication.)

Dated 24th *May*, 1856.

1242. John de Cockkenifeck, Cork—Improved process and apparatus for preparing, refining, and filtering oils or fatty matters.
1243. Pierse Eustace Laurence Barron, Coleshill-street, Eaton-square—Improved process for coating metals for sheathing ships and for other purposes, and in the means of attaching sheathing plates to ships or vessels. (A communication.)
1244. William Illingworth, Manchester—Improvements in printing or colouring and glazing china, earthenware, or other ceramic manufactures, and in the machinery or apparatus connected therewith, and also improvements in the subsequent treatment of such manufactures.
1246. Robert Adam Whytlaw and Alexander Mitchell, jun., Glasgow—Improvements in weaving.
1247. James Lea, Birmingham—Improvements in sun blinds.
1248. Frederick Peter Dimpfel, Philadelphia—Improvements in the construction of steam boilers and furnaces.
1249. Samuel Davey Liptrap, Albany-road, Camberwell, and James Wright, 10, Alfred-place, Newington Causeway—Improvements in apparatus for regulating the mode of supplying and drawing off water and other liquids.

Dated 26th *May*, 1856.

1250. Benjamin Nadault de Buffon, 13, Rue du Cherche Midi, Paris—A new apparatus for clarifying and purifying water and other liquids.
1252. Alphonse René le Mire de Normandy, 67, Judd-street, Brunswick-square—Improvements in obtaining fresh water from salt water.
1853. Wharton Rye, Manchester—Improvements in fixing or fastening rails or railways in their chairs.
1254. William Hulse, Birmingham—Improvements in metallic and other bedsteads, which improvement or improvements may be applied to other articles of furniture, and to framework generally.
1255. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in the treatment of coal, and in the purification, dessication, and agglomeration of coal, and in machinery and apparatus for such purposes. (A communication.)
1256. Bennett Johns Heywood, Leicester-square—Improvements in holders for leads, slate, and other marking materials.
1257. Frederick Charles Jeune, Gresham-street—Improved manufacture of floor-cloth.
1258. William Edward Newton, 66, Chancery-lane—Improvement applicable to quadrants and other instruments for taking the altitude of the sun or other objects. (A communication.)
1259. Thomas Foster, Brownlow-street—Improved apparatus for holding postage, receipt, and other stamps.
1260. Samuel Newington, M.D., Ticehurst—A preparation for destroying the fly or aphis, and other insects, on hop and other plants.
1261. John Roberts, Falmouth—Improvements in machinery for moulding bricks and tiles.
1262. Thomas Charlton, Brentwood, and William Turnbull, Rotherhithe—Improvements in steam-engines.
1263. James Baird, Edinburgh—A method of freeing the wool upon skins from burrs and other extraneous substances.
1264. Henry George Yates, East Smithfield—Improvement in treating wash waters in order to precipitate the greasy and soapy matters contained therein. (A communication.)

Dated 27th *May*, 1856.

1265. Ebenezer Talbott, Spring Vale, Staffordshire—Improvements in the construction of rails for railways.
1266. Frank Clarke Hills, Deptford—Improvements in the purification of gas.
1267. William Edward Newton, 66, Chancery-lane—Improvements in printing machinery. (A communication.)
1269. Frederick Peter Dimpfel, Philadelphia—Improvements in constructing the permanent way of railroads.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1288. William Needham and James Kite, Vauxhall—Improvements in machinery or apparatus for expressing liquids or moisture from substances.—31st May, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed June 6th, 1856.

2621. George Senior Tolson, Robert Henry Tolson, and Joseph Senior Tolson, and Thomas Irving.
2741. Jonas Marland and Samuel Marland.
2743. William George Wilson.
2751. Thomas Chaffer and Jonah Ellis.
2752. Johannes Neuenschwander.
2758. Jean Joseph Emilien François Kuister.
2809. Robert Midgley and George Collier.
2871. Richard Ruston.
2897. Charles Glover.
2919. Alexandre Tolhausen.
2934. John Robinson and Richard Cunliffe and Joseph Anthony Collett.
2950. Thomas Holmes.
63. Peter Armand le Compte de Fontaine-moreau.
84. Thomas Charles Clarkson.
269. Thomas Hurst.
270. John Henry Johnson.
572. David Brown and William Brown.
604. George Murray.
650. Lazare Ochs.
720. Thomas Barnabas Daft.
731. Joseph Tall.
770. Benjamin Looker, jun.
776. Henry Gornforth.

Sealed June 10th, 1856.

2780. John Hall., jun.
2784. David Parsons.
2790. Bernard Hughes.
2791. Bernard Hughes.
2793. Jean Marie Préaud.
2806. Martin Billing and Walter George Whitehead.
2814. David Hart.
2823. John Walter Friend.
2827. Charles John Todd and Robert Pinkney.
2829. Peter Haworth and Alexander Forrest.
2833. John Aspinall.
2834. Edward Brown Hutchinson.
2836. George Coats.
2842. Paul Marie Salomon, Jacques Loir Montagazan, and Charles Marie Joseph de Flers.
2844. George Collier and John Crossley, and James William Crossley.
2846. Henry Stewart.
2847. John Lobb Jeffree.
2870. George Ross and Thomas Wilkes.
887. David Dunne Kyle.
2899. John Gedge.
2901. James Newman and William Whittle.
2932. John Grist.
2942. Lewis Harrop, Samuel Barlow, and Alexander Boyd.
2951. William Edward Newton.
33. Robert Grey.
206. William Owen.

Patents on which the Third Year's Stamp Duty has been Paid.

June 2nd.

1422. Richard Archibald Brooman.

June 4th.

1391. Christopher Nickels and James Hobson.
1404. John Horrocks, jun., and James Dunlop Horrocks.

June 6th.

1416. James Robert Napier and William John Mackquorn Rankine.
1445. Arthur Parsey.

June 7th.

1409. Claude Arnoux.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3845	June 6.	Live Ring Turntable	J. E. McConnell	Wolverton.
3846	„ 6.	Improved Shirt Front and Collar	John Paterson	104, Wood-street, Cheapside.
3847	„ 6.	The Service Canteen	Lieut. Philip Harris	H.M. Royal Marines, Chatham.
3848	„ 7.	Portable Watercloset	John C. Stokes	Birmingham.
3849	„ 11.	Improved Magneto-Electric Machine	John B. Dancer	Manchester.

Journal of the Society of Arts.

FRIDAY, JUNE 20, 1856.

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THE ANNUAL GENERAL MEETING.

The Annual General Meeting, for receiving the Council's Report, and for the Election of Officers for the ensuing year, will be held on Wednesday, the 25th inst., at 4 p.m. In accordance with the Bye-law, sec. 84, which provides that "the balloting list shall be published with the *Journal* of the Society, on the Friday previous to the day of election, and a copy sent to every member of the Society," the balloting list duly prepared is issued with this number of the *Journal*. And in accordance with the Bye-law, sec. 42, which provides that "at this meeting the Council shall render to the Society a full account of all their proceedings and a statement of the funds of the Society, and of the receipts, payments, and expenditure, during the past year, and a copy of such statement shall be published in the *Journal* of the Society on the Friday before such General Meeting," the statement in question is now annexed.

ANNUAL STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31st MAY, 1856.

Dr.

	£	s.	d.	£	s.	d.	£	s.	d.
To Subscriptions for the year ending May 31st, 1856 :—									
From Members and Institutions in Union with the Society	3285	3	6						
Outstanding	1255	16	0						
				4540	19	6			
Deduct due on former years	407	8	0						
Estimated not recoverable	169	13	7						
				577	1	7			
				3963	17	11			
To Life Contributions				210	0	0			
							4173	17	11
To Dividends on Stock :—									
£3166 13s. 4d. Consols				88	13	4			
1969 10s. 6d. ditto, held in special trust				55	2	10			
388 1s. 4d. New 3 per Cent. Annuities				10	18	2			
							154	14	4
To Special Objects :—									
Royal Commissioners of the Exhibition of 1851, on account of Trade Museum				100	0	0			
T. Twining, Esq., in aid of the Working Classes Museum				130	0	0			
Special Prizes at the Examination of Students				36	0	0			
Chalon Exhibition—Sale of Catalogues, and Admissions				28	1	0			
Exhibition of Inventions, ditto				5	11	6			
Journal (Herr Kumpa, for Woodcuts)				3	3	0			
Microscopes, by cash	146	9	0						
Ditto, in hand	121	13	3						
				268	2	3			
For Repairs of Photographs from the Guildford and Halstead Institutions				1	0	0			
							571	17	9
							4900	10	0

Cr.

	£	s.	d.	£	s.	d.
By General Establishment Expenses :—						
Rent, Rates, and Taxes	220	17	0			
House and Office	128	0	2			
Salaries, Wages, and Commissions	842	9	2			
Postage Stamps and Parcels	119	0	9			
Stationery and Printing	121	4	9			
Advertisements	1	14	0			
Illustrations	0	3	6			
				1433	9	4
By Special Objects :—						
Medals and Rewards	20	12	0			
Trade Museum	196	7	10			
Museum of the Imports into the Port of London	10	10	0			
Working Classes Museum	64	10	1			
Paris Visits, expenses incidental to	100	17	0			
				392	16	11
By Journal	904	19	7			
Less charged to Union of Institutions	180	19	11			
				723	19	8
Exhibitions :—						
Patented Inventions, 1855-6	77	10	10			
Belgian Exhibition, 1856	0	14	0			
Chalon Exhibition	127	13	9			
				205	18	7
Committees :—						
Union of Institutions, including Journal, Postage, Stationery, Printing, and other charges	634	13	11			
Industrial Pathology Committee	5	14	0			
Paris Improvements ditto	4	14	0			
				645	1	11
Repairs and Alterations	29	10	9			
One Year's Interest on £1000	41	19	6			
Law Charges and Stamp Duty	18	9	2			
Library and Pictures	7	15	8			
Microscopes	268	2	3			
Dinner, 1855, Advertising, &c.	9	12	11			
				375	10	3
				3776	16	8
By Excess of Income over Expenditure				1123	13	4
				4900	10	0

BALANCE SHEET, 31st MAY, 1856.

Dr.

	£	s.	d.	£	s.	d.
To sundry Creditors, viz. :—						
To Tradesmen's Bills	£536	12	5			
Salaries and Commissions	17	17	0			
Debenture at 4½ per cent	1000	0	0			
Interest on ditto	11	5	0			
Loan by G. T. Kemp, 1846	50	0	0			
				1615	14	5
To Trust Liability in respect of Government Stock (Consols) held for specific purposes, as per contra, viz. :—						
Set apart to answer :—						
Swiney Prize	1333	6	8			
Acton Trust	536	3	10			
Stock Trust	100	0	0			
Fothergill Trust	388	1	4			
By Excess of Assets over Liabilities				2789	3	10
				£4404	18	3

Cr.

	£	s.	d.	£	s.	d.
By Cash in hand :—						
At Messrs. Coutts and Co.	£124	6	0			
At Commercial Bank	75	15	7			
In hands of Secretary	16	5	10			
				216	7	5
By Dividends due April 5, on £388 1s. 4d., New 3 p. Cts.				5	8	8
By Consols, £3166 13s. 4d., at 94				2975	2	0
By Royal Commissioners of Great Exhibition, on account of Expenditure on Trade Museum				529	5	9
By Subscriptions in arrear	1255	16	0			
Estimated as not recoverable to the amount of	577	1	7			
				678	14	5
By Government Stock held in trust, applicable to specific purposes, viz. :—						
Consols	1969	10	6			
New 3 per Cents.	388	1	4			
				£4404	18	3

16th *June*, 1856.

SAML. MORTON HUBERT, } *Auditors.*
W. B. SIMPSON, }
P. LE NEVE FOSTER, *Secretary.*

LIST OF LECTURERS, &c.

The Council have just issued to the Institutions in Union the Third General List of Lecturers, &c. A revised edition will be printed in the course of the next week.

LIABILITY OF SHIPOWNERS.

(From *Times* City Article, June 13th, 1856.)

The Steamship Owners Association of London have had an interview with the Board of Trade on the liability to which, under Lord Campbell's Act, they are subjected with regard to damages in case of loss of life. This liability is indefinite, and may extend to the whole amount of the shipowner's property, since, although the law limits it to the value of the vessel and freight, and assesses £30 as the sum for each life destroyed, it gives power to the representatives of the sufferers, if dissatisfied with that amount, to bring an action, and to receive whatever a jury may be disposed to give. It is alleged that the most extravagant damages are often awarded, even in instances where the neglect or want of judgment that led to the catastrophe has been of the slightest kind, and that consequently the peril to individual shipowners is such as to operate prejudicially not only on all their calculations, but likewise on the competition, especially in the emigration trade, with foreign shipping, which is hampered by no such penalties. It is argued, moreover, that as the Government by their recent legislation have imposed restrictions on the shipowner, such as requiring him to submit his ships to half-yearly inspections, and to employ certificated commanders, it is unfair to make him subsequently responsible to a ruinous extent for contingencies against which these precautions have proved insufficient, and that, in fact, the same principle should be pursued as in the compulsory employment of licensed pilots, where the shipowner is exonerated from all consequences. The Association stated, however, that, looking at the prevalence of "popular prejudice," and the consequent position of Government on the question, a considerable number of their body would be glad to accept a compromise in the shape of such a modification of the statute as would define and limit the extent of their liability. Thus £30, or even double that sum, for each case of loss of life might be the Parliamentary amount fixed, giving passengers at the same time a right to stipulate for a larger indemnity before taking their passage, and making it lawful for the shipowner to insure himself against such extra liability. In reply to these observations, the President of the Board of Trade pointed out that the responsibilities complained of, even under Lord Campbell's Act, are only such as lie upon all other members of the community, and that these have actually been mitigated by the Merchant Shipping Act, which limits them to the value of ship and freight. He considered, moreover, that there had been no evidence of their having operated as a discouragement, and that the analogy suggested between certificated masters and licensed pilots is inaccurate, since the master is under the control of the shipowner, while the pilot is totally independent of him. The only plea which seemed to render a reconsideration of the law desirable is the position in which it places the British relatively with the foreign ship-owner, but the Association were informed that all the other points urged by them, as well as this, should receive the attention of the Board. In reviewing the arguments on both sides, the public will feel that the sole end to be aimed at is the establishment of sufficient penalties to render it certain, on the average, that the neglect of precautions will prove more expensive than their fulfilment. Everything in excess of this must have a self-defeating result, since it would be calculated to cause the passenger to omit an adequate insurance for his family, and to trust to litigation on the liability of a shipowner, who in the end may prove insolvent, while it would also lead to a wide system of evasion, cases being said already to have occurred of the transfer of ships and their registration as foreign vessels, in order to relieve the owners of liability. Some pleas urged by the Association as to the leaning of juries against public companies in assessing damages, as well as with regard to accidents beyond the shipowner's control, are worthy of little attention, and the same may be said as to the remark on popular prejudice. The feeling of juries against public companies is fully explicable from the notorious acts of injustice frequently performed on the strength of their corporate position, of which their directors would individually be ashamed; while, as to the occurrence of accidents "beyond control," the illogical theory should have been considered too weak for reproduction. On the general bearing of popular prejudice respecting the liability of shipowners there can be no surprise, when the disregard of the most ordinary provisions for saving life—such, even, as the regular examination of the boats, and the adoption of the best means for lowering them, is illustrated in almost every fresh disaster that is recorded.

LINEN TRADE WITH FRANCE.*

By Robert Sturrock, Secretary to Dundee Chamber of Commerce.

The trade in linens and linen yarns between this country and France is comparatively of recent date, and the progress and decline of it is a striking illustration of the effects of moderate and prohibitory duties, proving how unfortunate it is when countries do not freely interchange their commodities.

It is proposed in the following remarks to give a short sketch of the variations in the duties for a number of years on linens and linen yarns imported into France, and to show the great advantages granted to Belgium since the serious alterations which took place in 1842. It is useless speculating as to the impetus which might have been given to the linen trade had the French lowered their duties at an earlier period than was done, but it will be seen how rapidly a very large intercourse sprung up between the two countries so soon as this was carried into effect. Considerable changes were frequently made in the French tariff during the various revolutions that took place in that country; and after the Restoration, France, in her legislation and practice, adopted in its broadest application the system of exclusion.

In the year 1826 the duties on linens were made very high, and this continued until 1836, when they were much lowered, and the classification so arranged as to admit the coarser description of goods at much reduced rates. The trade then gradually increased until 1842, at which time the same classification was continued; the duties, however, being not only raised to those of 1826, but made almost, if not altogether, prohibitory.

The effect of low duties was to be shown, however, in the export of linen yarns from this country. After a variety of changes, the duties were reduced in 1836 to rates equal to an *ad valorem* of from six to eight, ten, and twelve per cent. At that time the only classification existing was a difference in the duty on flax and tow yarns—a certain number of francs were charged on 100 kilogrammes, or 221lbs. English; this, of course, admitted fine yarns at a very low rate. In 1840 a slight change took place, the duties on flax yarns being kept the same, but the first classification in the size was made in that of tows, which were divided into two classes—the duty on those below No. 9 remaining as before, but all above were charged at a like rate with flax; this, however, had little effect. The first serious alteration took place in 1841. Flax and tow yarns were then treated in a like manner, and divided into four classes—the duty being increased, and chargeable according to their coarseness or fineness. This change, as was intended, pressed most heavily on the finer descriptions. Next year, however, an agitation was got up by the French flax-spinners, and the government of Louis Philippe (in keeping, we know now, with all his selfishness) acceded to their urgent solicitation, and in 1842 duties almost prohibitory were imposed. The same classification was continued, but the duties were not only doubled, but in some cases increased even more. This, however, was not yet sufficient for protection to native industry—fine yarns were still imported, and in 1845, so as to cause their exclusion, the fourth class was subdivided —then making five—and the duty on very high numbers was increased about one-third.

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* These remarks were drawn up for, and appeared originally in, the *Dundee Advertiser*. They have been somewhat changed in form by Mr. Sturrock, to suit the pages of the *Journal*.

Such is a short history of the duties which have been the cause of the "rise and fall" of the linen trade with France. That this country was deriving advantages, there can be no doubt, but so were the French nation in proportion. What did the French manufacturers say in 1840? In a petition to the French government, when a certain party was anxious for heavy duties being placed on British linen yarns, they stated that, "in order to meet foreign competition in linen, we ask but one favour—to leave us our raw material, yarns, as at present; we have lately beaten out English drills in the home market, and our own damask is rapidly replacing that which Belgium and Silesia sent us." And now, under the altered policy, for the article of linen they pay at least one-fifth more than they would do under a moderate system of duties—at least two and a-half millions sterling annually, whilst the aggregate capital employed in the flax-spinning trade in France is not greater than the annual loss sustained by that nation in keeping up prohibitory duties.

To show at one view the different changes which have taken place, we append tables of the duties, so made up as to give examples in each class of yarns and linens at the different periods:—

DUTIES ON UNBLEACHED LINEN YARNS IMPORTED INTO FRANCE.

Year.	6lbs. or No. 8.		3lbs. or No. 16.		2lbs. or No. 24.		1lb. or No. 48.		½lb. or No. 96.	
	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
1836	4	16⅘	3⅓	14⅓	2½	9⅓	1⅓	4⅘	0⅓	2⅓
1841	4⅓	19	3⅓	14⅓	3⅘	15⅘	3¼	13⅘	1⅓	6⅕
1842	11	46	6⅓	28⅓	7⅓	31⅓	5⅘	24⅓	2⅓	12
1845	11	46	6⅓	28⅓	7⅓	31⅓	5⅘	24⅓	3⅕	15⅘

DUTIES ON BROWN LINENS IMPORTED INTO FRANCE.

Duty on 291 lbs. English.

Year.	*8	*12	*16	*20	above *20
	s. d.	s. d.	s. d.	s. d.	s. d.
1826	52 1	84 2	136 4	280 7	280 7
1836	28 10	60 2	120 3	180 4	280 7
1842	64 2	115 5	214 0	274 2	374 4

* The number of threads of warp in 1-5th of an inch.

NOTE.—In order not to complicate the tables, the duties on Bleached Linens and Yarns are not given, but they were treated in a like manner.

A few figures, giving the value of the linens and yarns exported from this country at different periods, will prove how completely the trade followed the duties:—

	Linens.	Yarns.	Total.
In 1835	£61,612	£198,823	£260,435
1841	281,982	806,336	1,088,318
1843	137,965	482,357	620,322
1846	83,119	262,101	345,220
1854	65,237	48,427	113,664

A particular policy has thus annihilated a great branch of industry, which one country was ready to provide, and another anxious to receive—its increase showing it must have been carried on for their mutual advantage.

A curious anomaly, however, existed till very lately. Whilst giving protection to the spinners in France, by imposing high duties on foreign yarns, there was, at the same time, an import duty on flax of from £2 to £3 per ton. This tax on the spinners has been removed, and may not it be a prelude to some relaxation for the manufacturers? Napoleon III. has also, by imperial decrees, been reducing import duties on wood, iron, coal, &c.; but we regret to see, within these few weeks, when a bill authorising these alterations, and a report of the committee upon it, were being discussed in the Chamber of Deputies, the feeling manifested by the vast majority of the members was so strong against free trade, that amongst other things M. de Baroche, President of the Council of State, said:—"What has been the policy of France since the peace? Firmly Protectionist, prudently progressive. We will not abandon it. We formally reject the principle of free trade, as incompatible with the independence and security of a great nation, as inapplicable to France, and as destructive of our noblest manufactures. No doubt our customs tariffs contain useless and antiquated prohibitions, and we think that they must be removed. But protection is necessary to our manufactures." It is evident that there is a great want of information on the subject of free trade in France, and that they still seem to think it for their advantage to shut themselves out as much as possible from the rest of the world. But what do the words "protection is necessary to our manufactures" mean? Simply that the nation must pay a large tax for the production of commodities which might be got elsewhere at a cheaper rate. It is, therefore, probable, that the same result will eventually take place there as in England, viz., that the people will see it is for their interest to buy in the cheapest and sell in the dearest market, and that if those in power do not think proper to make the requisite changes in their commercial system, they will be called upon to do so by the great body of the consumers, who are paying for what is called "the independence and security of a great nation."

The existence of different climates and circumstances shows it was intended that one part of the globe should minister to the wants of another; and whilst we, with our coal, iron, vast appliances of machinery, and insular position, are eminently a manufacturing country, so should France strive to bring out her agricultural resources in a much greater degree than she now does. It must, therefore, be a matter of gratification that the French Government has reduced the duties on farm machinery, and that the Emperor is doing everything in his power to introduce all the newest implements of husbandry, and to adopt the latest improvements in tillage. The coming Agricultural Exhibition in Paris, under his auspices, will surpass anything that has ever been of a like description; and from the practical manner in which these movements are being executed, the day cannot be far distant when the wealth of France will be much increased by improvements in agriculture of every description.

Napoleon III. has declared that his reign is to be one of peace. Since its commencement he has been engaged in war; but, like ourselves, it was in a good cause, and it has been brought to a satisfactory conclusion. This war, however, has increased the burdens of the French nation considerably, and now that there is peace, the great object of their ruler is to give them every chance of bearing these and other burdens as easily as possible. The continuance of his dynasty greatly depends upon increasing the comfort and wealth of his people; and knowing, as it appears he does, that free trade, which has worked so advantageously for Great Britain, will likewise bring prosperity to France, there may be good hopes of the commercial relations between the two countries being established on such a footing as to produce the happiest results to both, and bind them together by ties stronger than any political treaty.

It is well said by an Edinburgh Reviewer, comparing the rural economy of France and Britain, that "the stability of the political institutions of the country (France) may be more powerfully affected by an insect in a blade of wheat than by all the magnificence which surrounds the throne; and, if a larger proportion of that intelligence and capital which are profusely expended in France upon the decorative and unproductive arts, could be turned to the elementary purpose of procuring food and clothing on the most advantageous terms for the service of man, Louis Napoleon might be surrounded by a less luxurious court, but he would rule over a more prosperous and contented people."

With regard to Belgium, after Louis Philippe had made the duties on the linens and yarns of the United Kingdom almost prohibitory in 1842, he permitted, by a special treaty, the same articles to be imported from Belgium at rather less than half the duties charged on our British manufactures, Belgium being made to place similar duties on these articles entering that country from the United Kingdom.

In order to exhibit the exact difference, we now append the following tables of the duties charged on unbleached yarns and brown linens imported into France from the United Kingdom and from Belgium. They have been carefully made up, and give examples of the different classes; that of the yarns being suited for the English and Irish, as well as for the Scotch mode of making up. It can be no matter of surprise that our exportation has fallen off, and a mere glance at these tables will be sufficient to show the good grounds our spinners and manufacturers have to complain of the partiality shown to Belgium.

DUTIES ON UNBLEACHED LINEN YARNS IMPORTED INTO FRANCE.

	6lbs. or No. 8.		3lbs. or No. 16.		2lbs. or No. 24.		1lb. or No. 48.		½lb. or No. 96.	
	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.	per Sp.	per Bd.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
From Belgium......	4½	19	3½	14½	3¾	15¾	3½	13¾	2	8¼
From the United Kingdom	11	46	6¾	28½	7½	31¼	5¾	24¼	3¾	15¾

DUTIES ON BROWN LINENS IMPORTED INTO FRANCE.

Duty on 221 lbs. English.

	*8		*12		*16		*20		above *20	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
From Belgium	24	6	51	1	102	2	153	4	238	6
From the United Kingdom	64	2	115	5	214	0	274	2	374	4

* The number of threads of warp in 1-5th of an inch.

NOTE.—In order not to complicate the tables, the duties on Bleached Linen and Yarns are not given, but the difference is in a like proportion.

Belgium has for a long period supplied France with linens and yarns, but with a much smaller quantity of the latter. Previous to 1843—the year immediately following the imposition of the differential duties—there had not been exported to France much above 900,000 kilogrammes of yarn in any one year. To prove most conclusively how this country, under moderate duties, was able to supply France cheaper—competing successfully with Belgium—and how the people were quite prepared to become manufacturers themselves on getting a lower priced article, it is only necessary to give the importation of yarns into France at two different periods—the first under the existence of high, and the other under moderate duties:—

	From Belgium. Kilo.	From U. Kingdom. Kilo.
In 1830.........	881,000	3,000
In 1839.........	499,000	6,167,000

And in 1841—the year previous to almost prohibitory duties—the exportation of linen yarn from this country had reached ten millions of kilogrammes, which at two and a fifth lbs. gives 22,000,000 lbs. English. It is unnecessary to doubt how much France must have gained by this increase of trade, and still it has been put an end to on the ground of protecting native industry.

The following table exhibits the total quantity of linen yarn, and of unbleached linens—the bleached being a small proportion—imported into France during a series of years, giving at the same time the quantity from Belgium. It does not go farther back than 1842, for up to that year this country and Belgium were upon the same footing, and the trade from the United Kingdom, under moderate duties, had increased so gradually and so satisfactorily, that there could be no grounds for complaint. Whilst the table shows that, under differential duties, Belgium has now succeeded to almost the whole importation, it demonstrates very clearly, from the falling off in the importations, how much is now spun and manufactured in France, and how a trade can be forced into existence and increased by artificial means. The number of spindles employed in the linen trade in France in 1840 was only 57,000, whilst 1853 there were 395,800. This, however, has been brought about entirely by a nation submitting to be taxed for the support of a manufacture which can be procured cheaper elsewhere; and as dearness must curtail the consumption in France to a very considerable extent, we doubt not that, being the cheapest producers, were the duties on our goods only equalised to those of Belgium, a considerable trade would again arise, and the linen manufactures, in place of being carried on in Belgium, would be at once taken up by French manufacturers and carried on in France. Both countries would thus be greatly benefitted by the change in many ways:—

IMPORTED INTO FRANCE.

	LINEN YARN.		UNBLEACHED LINENS.	
	Total Importation.	From Belgium.	Total Importation.	From Belgium.
	Kilograms.	Kilo.	Kilo.	Kilo.
1842................	11,659,812	578,453	3,942,376	2,361,353
1843................	7,817,575	1,134,606	2,564,609	2,115,746
1844................	8,127,588	1,806,258	2,697,202	2,364,937
1845................	7 313,460	2,341,724	2,707,517	2,469,924
1846................	5,070,875	1,809,374	2,763,074	2,252,707
1847................	1,988,732	1,191,897	1,618,069	1,487,213
1848................	424,585	255,688	768,186	731,052
1849................	921,500	734,900	1,121,610	1,022,085
1850................	1,101,000	830,200	1,456,811	1,366,914
1851................	1,112,060	651,000	1,130,554	1,053,026
1852................	1,112,086	730,734	1,135,933	1,028,027
1853................	1,136,207	947,986	1,257,153	1,218,012
1854................	708,564	567,847	845,424	777,[illegible]

1 Kilogramme = 2 1-5th lbs. English.

It is gratifying, however, in the meantime, that the free traders of Belgium have agreed to summon a Congress for September next, to be composed of representatives of all nations, to take into consideration how far existing fiscal laws and regulations interfere with the extension of commercial relations between the various countries of the world, and to devise the best means for extending the application of free-trade principles. This movement is in the right direction, and we hope it will be supported by the large mercantile towns in this country in such a manner as to forward their views. Should Belgium take a lead, and arrange her tariff—at present a restrictive one—upon a free and liberal principle, France, as her nearest neighbour, must follow for her own advantage and safety.

The following table shows the exportation of linens and linen yarns from the United Kingdom to France, from 1830 to 1854, and gives the proportion to the total quantity of British and Irish produce and manufactures exported to the same country in the like period.

Year.	Linen Manufactures.		Linen Yarn.		Total Declared Value of Linens and Yarns.	Declared Value of all Exports of British and Irish Produce and Manufactures to France	Per cent of Linens and Yarns to all Exports of British & Irish Produce
	Yards.	Declar. Value.	lbs.	Declar. Value.			
		£		£	£	£	
1830	102,993	11,140	2,724	200	11,340	475,884	2·38
1831	102,642	8,265	17,503	1,095	9,360	602,688	1·55
1832	314,100	16,015	76,512	6,516	22,531	674,791	3·33
1833	183,598	13,055	867,288	68,299	81,354	848,333	9·58
1834	263,961	21,518	1,430,369	130,561	152,079	1,116,885	13·61
1835	1,247,901	61,612	2,384,678	198,823	260,435	1,453,636	17·91
1836	1,998,158	118,666	4,012,141	276,942	395,608	1,591,381	24·86
1837	3,668,388	142,812	7,010,983	401,007	543,819	1,643,204	33·09
1838	7,633,291	273,854	11,485,680	600,806	874,660	2,314,141	37·75
1839	6,255,476	246,829	12,259,264	644,144	890,973	2,298,307	38·76
1840	6,792,485	225,505	13,137,367	629,533	855,038	2,378,149	35·96
1841	8,823,503	281,982	20,832,875	806,336	1,088,318	2,902,002	37·50
1842	8,586,667	270,019	22,202,292	749,675	1,019,694	3,193,939	31·94
1843	4,379,601	137,965	13,824,285	482,357	620,322	2,534,898	24·47
1844	4,976,718	173,454	13,546,757	501,244	674,698	2,656,259	25·40
1845	2,366,082	102,440	9,153,188	414,350	516,790	2,791,238	18·51
1846	1,950,763	83,119	5,806,568	262,101	345,220	2,715,963	12·71
1847	1,326,265	71,939	1,662,173	116,990	188,929	2,554,183	7·39
1848	860,598	45,568	259,521	23,003	68,571	1,025,521	6·68
1849	1,518,245	81,543	542,334	50,213	131,756	1,951,269	6·75
8540	1,587,039	90,222	690,602	69,261	159,483	2,401,956	6·63
1851	1,353,097	76,489	863,777	64,888	141,377	2,028,463	6·96
1852	1,692,987	95,988	793,845	79,302	175,290	2,731,286	6·41
1853	1,774,832	110,069	487,811	66,680	176,749	2,636,330	6·70
1854	1,211,832	65,237	291,983	48,427	113,664	3,175,290	3·57

Colonial Correspondence.

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THE NATURAL RESOURCES OF BRITISH HONDURAS.

Belize, British Honduras, May 15th, 1856.

SIR,—I regret to learn that the roes of the callipever did not reach you in good order. I am the more sorry for this, because this is not the season when that article can be procured. I shall, however, seize the earliest opportunity to furnish myself with a fresh supply, for I feel persuaded that it would prove a very valuable mercantile commodity; and I am by no means sure that it would not merely be a substitute for, but would be preferred to caviare. It should not be forgotten that the roe of the callipever is capable of being prepared in the same manner as that of the sterlet and the sturgeon in Russia and Prussia. The next sample which I send I will cover with a thick coating of gum arabic, and by that means, the air being excluded, I hope they will be thoroughly preserved. With respect to the fish itself, I am not surprised at the opinion expressed. It was, in fact, too much dried in the sun before it was packed up. The next which I forward I will place in a small keg, along with some brine. But the callipever, to be properly estimated, should be eaten when fresh, and "this consummation most devoutly to be wished" is not impossible. The fresh salmon is preserved in tins and sent out to the West Indies, and, although when it arrives there, it is very unlike what it is when it is newly caught in the Tay or the Tweed, it is yet very palateable to those whose "heart is *not* in the Highlands." There is nothing to prevent the callipever from being sent to England in a similar manner. I really think that Mr. Gamble (if there be such an individual, and the name is not a commercial fiction, like Price and Co.), or any other gentleman engaged in his line of business, would find his account in sending some person to this country who thoroughly understands the process of preserving meats, with all the necessary means and appliances. He ought to be accompanied by a good tinner. I will mention a few things which might be preserved in Honduras, and which, I have no doubt, would find a ready market in England. First and foremost, then, there is the turtle, that must not be overlooked. The turtle of Honduras attains to a very large size, and it is extremely delicate and fat. In consequence of the number of coral reefs which run along the whole coast of Honduras causing the water inside to be very shallow, the turtle feeding grounds, on which a species of moss or grass grows, are very extensive, stretching for several hundred miles. The supply of turtle might be almost unlimited. Any one engaged in the preserving and exportation of this wholesome and nutritious food, would do well to proceed somewhat after this manner. He would first contract with the turtlers for an ample supply of this testaceous fish, at so much a pound—say one penny. He ought to get it at that price, considering that the shell would be weighed in. Having thus caught—not his hare, as the worthy Mrs. Glass would say—but his turtle, he would separate from it the green fat, the neck, the fins, and the breast, which is called the callipee. These are the only parts which are worth preserving. The fleshy portion he would be able to sell in the market for steaks at twopence per lb. The greater part of the flesh when boiled down becomes gelatinous. Those square pieces of turtle which float about in the soup in company with diverse coloured balls, at city feasts, and which lord mayors and aldermen, not to say recorders and common serjeants, in the innocence and simplicity of their hearts, put into their mouths as green fat, swallow as green fat, and digest as green fat, are really and truly nothing more nor less than bits of turtle glue, which Birch and other great culinary criminals impose upon them as the real Simon Pure. Very likely they themselves are not better informed. But the true, genuine, unsophisticated fat is never found in a turtle after it has performed a sea voyage. "Lively," the animal may be—but fat—certainly not. It would be a mistake to attempt to manufacture and export the soup. The parts which I have above mentioned should simply be boiled down, and packed up in tins hermetically sealed. Another article which might be preserved and exported, and which would I have little doubt be highly prized by epicures in England, is the liver of the hiccatee. The hiccatee is the fresh-water turtle, or tortoise, and is, I believe, altogether unknown in Europe.. It never approaches to anything like the size of the largest turtles. The weight of a hiccatee seldom exceeds 20 lbs. It has not got fins like a turtle, or, to be more correct, the sea tortoise, but round, webbed feet, each having five claws, like those of a duck. It is made for the land, therefore, as well as the water. It does not, however, make the former its home, and its feet are evidently intended merely to enable it, when one pool becomes dry, to travel in search of another. The hiccatee is generally caught in the dry season, when going "across the country" in pursuit of water. The feet when dressed are gelatinous, but the flesh is dry and fibrous. It is, however, the liver which renders this species of tortoise so highly estimable. It is a dark olive colour, and immensely large. If this were preserved in oil with truffles, it would be considered far superior to the goose's liver, of which the *pâté de foie gras* is made. The eggs of the iguana are another article deserving attention. One of these lizards sometimes contains as many as four-score eggs. It is about the size of a pigeon's egg, with a very soft shell, which contains only a very small quantity of the albumen. The yolk, unlike the yolks of other eggs, does not become hard and dry when boiled, but is soft and melting as marrow. It would be a refreshing sight to see Alderman A., or Sheriff B., or any other civic dignitary who has gone the round of all the dishes which native and foreign skill have been able to produce, and to whom a new combination would convey as much delight as a black tulip or a fresh dahlia would to a horticulturist, partaking, for the first time, of *pâté de foie gras de l'hiccatee*, or a dish of the eggs of the iguana, garnished with anchovies. What I have mentioned, are only a few of the very excellent things which might be preserved and sent to England, in exchange for Highland mutton, Scotch collops, and fresh salmon. I state these facts, and I can do no more. If those who are interested in them will not take the hint, it is not my fault.

Some years ago, a Mr. Gunter set up a turtle establishment in Belize, but his scheme failed; why, I do not know. I suspect, however, that he attempted to manufacture a rich soup, which would only require to be warmed and sent to table. This certainly was a great error. I repeat that the fins, the neck, the breast, and the green fat should simply be boiled and hermetically sealed up. The soup should be made in England.

I am, &c.,

R. TEMPLE.

Home Correspondence.

THE JAMAICA SOCIETY OF ARTS.

Sir,—I have the satisfaction to enclose a resolution passed at a General Meeting of the Royal Society of Arts of Jamaica, expressing its thanks for the favourable consideration given by the Council of your Society to the application made by the Society in Jamaica for admission into Union, resulting in the general extension of the principle to Colonial Institutions.

You will please lay the resolution before the Council at its next meeting.

Since our Local Society was accepted in Union it has received the gracious patronage of her Majesty the Queen and H.R.H. Prince Albert, under which it has assumed its present style. While thus announcing the condescension of her Majesty and her Royal Consort, I should make mention of their munificence, as the royal patronage was accompanied by a donation of £150 in aid of a fund urgently required to enable the Society to carry into effect its various objects.

Emboldened by this generous grant, testifying at once to the sympathy of our Sovereign for a suffering colony, and the royal approbation of the work undertaken by the Society, and impelled by the pressing necessity of crippled means, the Council has forwarded to its agents a memorial, addressed to the patrons of arts and science in Great Britain, in which, while the proposed organisation is explained, the inability of the inhabitants to provide the requisite funds to meet the first outlay is submitted by way of appeal for aid.

If you can spare the space, perhaps you will so far assist me as to insert the enclosed statement of the proposed organisation in an early number of the *Journal*. I venture to make this suggestion, knowing the interest you have already evinced in the cause I seek to advance.

LEONARD ROWE VALPY.

The Addison-road, Kensington.

Statements Referred to in the Foregoing Letter.

The Royal Society of Arts of Jamaica took its origin under the government of Sir Charles E. Grey, such an institution having been suggested by her Majety's Government, but a severe political crisis stayed its effectiveness until it was reorganised by Sir Henry Barkly, who, in the year 1854, issued a circular calling upon the members to reunite, and secure a representation of the natural resources and industrial products of the island in the Paris Exhibition. The collection which was forwarded secured the award of *three* first class medals, *five* second class medals, and in *nine* instances honourable mention was made of articles exhibited.

But the Society, being reorganised, aims at still higher purposes, and seeks to operate on a much broader basis. It seeks to encourage the development of the vast natural resources of the island, and to open up new channels of commercial wealth—hitherto neglected or unknown. It seeks to instruct the mind, improve the taste, and give an impetus to industry.

It is considered that the objects specified can to a great extent be effected by means of the following organisation. 1. Local Exhibitions; 2. A Museum, with Library and Lecture Room attached; 3. A Journal of Transactions; 4. Model Industrial and Reformatory Schools; 5. Horticultural and Experimental Garden; 6. Botanical Magazine.

Much time and careful management will doubtless be required before these plans can be fully adopted; but they have been accomplished in other countries, and there is no insuperable hindrance to the realisation of such high purposes in Jamaica.

1. Local Exhibitions.—The first local exhibition was held in February, 1855, and consisted of the collection afterwards sent to Paris. Such a display—at once interesting, elevating, and instructive—could not but speak to the spectators in the language of popular instruction; and if the satisfaction expressed by the visitors (exceeding 3,000 persons from all ranks of society) may be received as any evidence of the interest aroused, the Society was justified in declaring its conviction that a new era would from that date commence in the industrial pursuits of the inhabitants of the colony.

The second annual exhibition was opened in March, 1856, and the contributions were largely in excess of those procured in the previous year. This collection, however, was not all that the Society could have wished, or what it would have been had the necessary funds been at command to employ competent agents.

By annual exhibitions it is hoped that a spirit of emulation will be infused amongst producers of all classes; and by this means the Society will be enabled from time to time to test, and secure evidence of, the material condition and prospects of the people.

It is much to be desired that the principle of awarding premiums for practical advancement, arising from superior industry, intelligence, or skill, should be introduced, but at present the means are wanting.

2. Museum.—The articles collected in the Exhibition of 1856 will form the nucleus of the Island Museum, which is designed chiefly to exhibit the riches of the animal, mineral, and vegetable kingdoms, as stored in a country so highly favoured in its natural gifts, and to trace the application of local industry.

Much progress has been made in the organisation of this Institution—including the library—and valuable contributions in the various departments have been received from local sources; but all action requiring any considerable outlay (such as the employment of a curator and librarian) is necessarily suspended in the existing pecuniary position of the Society.

3. Transactions.—This publication has been issued monthly since December, 1854. Vol. I. contained 153 pages (post 4to.), and three numbers of Vol. II. have already been circulated. It contains minutes of the proceedings of the Society, and papers read at its meetings, whereby much valuable information, hitherto scattered, is brought into due order, and laid out for general instruction and application.

4. Schools.—By means of the schools a feeling of the true value of labour, and habits of frugality and mutual support in case of casualty or need, may be inculcated. In fact it is a spirit of true independence and self-reliance which is the great want of the peasantry.

5. Garden.—The establishment of the proposed garden may lead to the spread of a taste for horticulture, which it is hoped would reach the peasant proprietors, and attention might be drawn to cottage economy. It would also afford a nursery for medicinal plants, under the eyes

of the leading members of the medical profession; and the result of careful culture of the varied fruits of the island could be ascertained.

6. Botanical Magazine.—Through the pages of this publication the higher branches of botany, as applicable to Jamaica, would be brought within the reach of students. Many plants figured by such an authority as Dr. Woodville are found, on comparison with the natural foilage, to be incorrectly drawn, and such errors would thus find a medium of correction. Instructions for the cultivation of cottage gardens, as gathered by experience, could be published in a separate and cheap form.

The Society anticipates an additional sphere of usefulness by interchanging specimens in various branches of natural history with other Societies of a similar nature in various parts of the world, especially in Great Britain.

It is believed that the objects and efforts thus shadowed forth embrace a system thoroughly adapted to the urgent wants of the colony—including the well-being of the lately emancipated inhabitants—and that much of the future social and material prosperity of the country is (humanly speaking) dependent on the result. This view is confirmed by the gracious patronage which has been bestowed on the Society by her Majesty the Queen and H.R.H. Prince Albert.

The Society of Arts in England has extended the benefits of association and union to Colonial Institutions, and the Society in Jamaica has gladly availed itself of this advantage.

The members of the Society, being principally inhabitants of the colony, number about 300. The income is derived solely from the annual subscription (12s.), and entrance fee (8s.); this source hardly covers the casual current expenditure. All that has hitherto been effected towards advancing the objects specified, has been done gratuitously by a few willing co-operators, stimulated and aided by the influence and ever-active exertions of their president, Sir Henry Barkly.

In the depressed condition of the colony the legislature has not been able to do more than recognise the usefulness of the Institution by a small pecuniary grant of £150, and it is found necessary, in order to ensure extended operation, to seek extraneous aid.

It is thought that some of the societies and public bodies in the mother-country, and many of the patrons of art and science in Great Britain, as also many gentlemen who by commercial relations, or otherwise, are connected with the island, following the generous example of her Majesty and H.R.H. Prince Albert, may take an interest in the efforts of the Society, and strengthen its hands by pecuniary donations, and other useful contributions. To this end an appeal has been forwarded from Jamaica, which lies for perusal, with the rules and transactions of the Society, at the office of A. F. Ridgway, Esq., 42, Leicester-square.*

TONNAGE REGISTRATION.

Woolwich Dockyard, 17th June, 1856.

Mr. Atherton requests the favour of the publication in the *Journal of the Society of Arts* of the enclosed letter, addressed to the editor of the *Mechanics' Magazine*, in reply to the editor's letter on tonnage registration published in the *Journal of the Society of Arts* on the 13th inst.:—

To the Editor of the Mechanics' Magazine.

Woolwich Dockyard, 17th June, 1856.

Sir,—It gives me satisfaction to find by your article on "Tonnage Registration," published in the *Mechanics' Magazine* of the 14th inst., No. 1,714, and in the *Journal of the Society of Arts* of the 13th inst., No. 186, that my letter of the 27th ult., in reply to your review of my paper, "Tonnage Registration," read before the Society of Arts, on the 16th January last, has afforded you such a further exposition of my views on the deficiencies of our tonnage registration under the Merchant Shipping Act of 1854, as induces you to "congratulate Mr. Atherton upon the manifest improvement which has taken place in his opinions." Whether, however, this more approximate concurrence of our opinions may be attributable to any change in my views as to the deficiencies of our present tonnage registration system or to your own clearer perception of what my views really were and still are, I need not now question. The result is gratifying to me, for every writer on scientific subjects must desire to stand well with the editor and patrons of the *Mechanics' Magazine;* but I now further desire that our passive concurrence of opinion, embracing, as it does, the main principles of the case in question, may result in our active co-operation with a view to the amendment of our present shipping registration system; and, inasmuch as you have distinctly announced and adopted the propositions which substantiate the grounds of my exposition of the deficiencies of our present system, namely :—

1st. "That the tonnage measurement and registration of vessels has never been fairly brought before Government in any other than a purely fiscal point of view."

2nd. "That Government, in legislating on tonnage registration, has not contemplated the scientific features of the case, nor those which bear on the dangers of the sea voyage."

3rd. "That, undoubtedly, there is a point beyond which ships can not be safely loaded."

4th. "That, undoubtedly, it would be very desirable, *if possible*, to fix a limit to the degree in which ships may be loaded."

5th. That as respects the draught of water at which ships leave port, "Let the Board of Trade have, if it so please, properly authorised officers to note and record these facts."

Such being your acknowledgments in your review on my paper on "Tonnage Registration," read before the Society of Arts, on the 16th January last, I may surely presume it to be your opinion that the present state of our shipping registration system does not fulfil the statistical requirements of the times, and that the Act of 1854, as respects the matters above referred to, ought to be amended, "if possible."

Now, as regards the *possibility* of amending these declared and admitted deficiencies of the Act of 1854, it may depend considerably on the steadfastness of purpose which you, the Editor, and the numerous and influential patrons of the *Mechanics' Magazine*, and the members of the Society of Arts (to whom, also, you have appealed on this subject) may display in the prosecution of this good cause. It may, indeed, happen that neither the Editor of the *Mechanics' Magazine*, nor Mr. Atherton, nor any other loyal agitator in this good cause (for, in these days of popular education and advancement, the correction of deficiency or abuse in any department of national affairs, constitutes the very essence of loyalty), may not be so fortunate as to devise, all at once complete, that scheme of statistical registration which, on "*consultative deliberation*," may be decided upon as practically the best. For my part, I have not presumed that such would be the case; but, nevertheless, I have endeavoured to lead attention to the subject by pointing out the glaring deficiencies of the present law, and specifically bringing forward suggestions which, I believe, would constitute a practicable system, and which, embracing, as it would do, the capacity or roomage of ships for *bulk* of cargo, the capability of ships for carrying *weight* of cargo, the displacement at a certain specified draught, and the draught at which ships actually leave port, either above or below some assigned line, mark, or nail at stem and stern as of old, would, I conceive, constitute a scheme of shipping statistics more in accordance with the requirements of the times than is afforded by the present law. These suggestions, avowedly submitted in deference to further "consultative deliberation" scientifically competent to the task and biased by no class-prejudices on the question, are quite in accordance with my original paper; and if these views as to the purport of my paper have not been already noticed by the Editor of the *Mechanics' Magazine*, I hope they may now be regarded as a still further "improvement in Mr. Atherton's opinions," and become the subject of your still further congratulations and adoption, as a zealous co-agitator in the cause of shipping registration amendment. If I only obtain the active co-operation of the Editor of the *Mechanics' Magazine* to the extent of his own declarations, as above set forth, I will not quarrel with him, though he claim Captain "Coryphæus" as a convert, instead of acknowledging himself to be a recruit.

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* Copies of these documents have been placed in the hands of the Secretary of the Society of Arts, John-street, Adelphi.

Being thus in the amicable mood, I am not disposed, indeed it would be bad agitation, to disturb our harmony on principles by discussing matters of detail in practice; I may, however, remark on, not discuss, a few points. You question whether a ship of 1,000 tons register may or may not carry 3,000 tons *weight* of cargo. My statement was, that a ship of 1,000 tons register might be so proportioned as to carry 1,500 tons of cargo by *weight*, and, in addition thereto, 1,500 tons of cargo by *measurement;* making altogether, not 3,000 tons of *dead weight* cargo, but 3,000 tons of cargo chargeable for freight. The cellular principle of build now adopted in iron ships, would easily realise these limits, and the tonnage measurement of steamers is evidently open to still more anomalous results, as their register tonnage has no limited ratio whatever to their external displacement.

You appear to infer that I especially advocate external measurement: the first object of my original paper was to expose the fallacy of basing shipping registration on internal roomage only, as by the Act of 1854. I admit that, of the two, I would prefer a scheme of registration based on external displacement to a scheme based on internal roomage. I advocate neither exclusively; but I assert that shipping registration always must be a vexed question, so long as the legislature are imposed upon, as they always hitherto have been, with the idea that it is a question between *external* and *internal* measurement. Shipping registration never can be complete until some cognizance be taken of the measurements both internal and external; and by reference to the "Table of Details for Record" given in my original paper read before the Society of Arts on the 16th January, it will be seen that the scheme of measurement proposed by me is quite as complete for determining *internal* roomage, or capacity of the ship for bulk of cargo, as it is for determining the *external* displacement or capability of the ship for *weight* of cargo. Your notions as to my views in this respect appear to have been completely at fault; but I hope that, by this explanation, I have now established a concurrence of opinion between us as to the much vexed question of external and internal measurement.

I must also notice another point of importance, namely, the determination of the loading limit. At present, every ship receiving cargo has her load-limit, on which safety at sea so much depends, determined by interested parties. My argument is, that it ought to be determined by disinterested parties; and as you have now expressly *disclaimed* the impossibility of fixing a limit for each mercantile ship, I presume that you will *concede* the possibility of doing so. In my paper I left the mode of effecting this object an open question, to be settled by "consultative deliberation," suggesting, however, that the breadth of beam conjointly with the angle at which ships, according to their build, are liable to lie over, might be made the base of investigation. You have suggested that the ratio of length to breadth be also made an element in the calculation, in which I concur. Other ingenious suggestions may also present themselves, so it is to be hoped that "consultative deliberation" will overcome this stumbling-block, so lately an *impossibility*, but now merely a *difficulty*, and, perhaps, by this day twelvemonths, a simple question of proportion. As to the question of levying tolls fairly, on what principle are we to judge? Is it to be the gross SIZE of the ship, or is it to be the capability of the ship for carrying cargo that is to be the measure of fairness? A steamer of 100 tons register tonnage may be ten times as big, cubically, as a sailing vessel of the same register tonnage. Is it fair to exact the same amount of fiscal tolls from each, as is done by the present law? As to the capability for carrying cargo, it is, I believe, statistically known that the tonnage freight by *weight* and the tonnage freight by *measure* are about equal; and seeing that the roomage of a ship for carrying bulk tonnage is no measure whatever of the capability of a ship for carrying weight tonnage, unless submerged deck awash, which you repudiate, it cannot be said on this principle that the levying of tolls is fairly based on internal roomage alone. Would not the capability for weight cargo be at least equally fair, and would not the medium between the cargo *roomage* tonnage and the cargo *weight* tonnage be, on the general average, fairer than either? or would not a direct toll on the goods be fairest of all? Here, again, is a case for "consultative deliberation."

As regards measurement by Sterling's rule, I am reluctant to say more on that subject, since you yourself have so elaborately expounded it and referred it to the judgment of the readers of the *Mechanics' Magazine;* and as respects Peake's system of admeasurement based on the curve of vertical sections, I dare say that Mr. Peake will himself publish it more fully than has hitherto been done; and, if I may be permitted to judge from your exposition thereof, I have no doubt it will be more highly appreciated by you, when better understood than it appears to be at present. The constructive elements to be measured for determining shipping registration must necessarily be specified and prescribed by law, but, for my own part, I see no reason why Sterling's rule should be imposed by Act of Parliament on shipping as the mode of working out a calculation any more than that it should be imposed on land surveying or other purposes for which it is applicable. There is no more mystery necessarily connected with the measurement of a ship than there is with the measurement of a tub. Why should it not be left to those who are responsible for calculations being correctly done to adopt Sterling's rule, or Peake's method, or any other of the various methods that may be in approved general use, and recognised as scientifically admissible for the purpose required? Is science likely to be promoted by legislative protection? Here, again, is a case for "consultative deliberation."

I trust that the editor of the *Mechanics' Magazine* will now recognise a still further "manifest improvement in Mr. Atherton's opinions," and take a decisive part either in upholding our shipping registration system as it now is, or declare himself an advocate for its amendment. The patrons of the *Mechanics' Magazine* may wish to know the decision of its Editor; and is not such a decision due to them and to this public cause?

I remain, Sir,
Your very obedient servant,
CHAS. ATHERTON.

IMPROVEMENT OF POPULAR EDUCATIONAL INSTITUTIONS.

SIR,—This subject has made large advances since my letter to the Council regarding it. The Committee of Council's most wise minute offering assistance to institutions which appoint competent permanent teachers, is the most important educational step made since the celebrated minutes of 1846, which founded the pupil-teacher system; and if the institutions rightly apprehend their own high mission at this juncture, and the best mode of solving the problems which have perplexed them so long, I have no doubt that they will unitedly hail what I have the honour to submit for their consideration at the coming Conference, and what the Committee of Council, I feel sure, would concede gladly.

All admit that apparatus, books, &c., are indispensable to the work of education, and that assistance towards procuring these is most important; but as the body without the spirit is dead, so these, without earnest, competent, settled teachers are dead also. Man is the potential agent to act upon man, and without this agency the masses will be untouched, albeit, a few may derive advantage from the educational machinery placed within their reach.

Those who value mental culture will contribute, as far as possible, towards the payment of the persons whom their institutions select as instructors, but everywhere we find a deep-seated fear lest their numbers and means prove unequal to the burden. If this be so, good feeling and the soundest maxims of political philosophy point it out as a case in which the Committee of Council should lend assistance by contributing, ungrudgingly, towards the salaries of competent settled teachers. This is done for the child up to his eleventh or twelfth year—why should it stop then, and prove, as it too often does, mere money thrown away?

It is done for these very institutions themselves *in the matter of Art* with an almost universal feeling of satisfaction. Why not extend the provision to *Literature and Science?* Art is important, but these other departments of education are certainly not less so, and it does appear that logical consistency requires the Committee of Council to make, and the institutions to avail themselves of, the provision which I have ventured to indicate. May we not hope that the coming Conference will accomplish this object?

Assuming the location in our educational institutions of competent certified instructors well provided with books and apparatus, it is reasonable that they should be made as useful as possible.

To this end the Committee of Council might fairly ask in return for its grant that the teachers of all elementary schools under inspection, situated within the district of the institute, be admitted free to the lectures delivered by the certified instructors.

It might also stipulate that one or two lectures per week be delivered by each certified teacher in the daytime, specially for children attending elementary schools under inspection, the children in such schools being admitted free, or at a small charge.

Thus elementary schools would become nurseries for the institutions, and a culture would be provided for the saplings which is now found wanting.

Of course this plan proposes that qualified inspectors should visit the institutions annually, and report upon the progress of the students, and I think it would not be difficult so to arrange the examinations that the names of the students might be placed according to merit, and transmitted to the governing body of the institute who would publish the list, and reward as they saw fit those who had attained distinction.—I am, &c.,

W. R. BOWDITCH.

St. Andrew's, Wakefield, June 11, 1856.

DECIMAL COINAGE.—MR. SMEE'S PROPOSAL.

Sir,—In the last number of the *Journal* your correspondent, Mr. Smee, truly observes that, "unless some system be adopted by which our present coins shall bear a definite relation to decimal coins, decimals must remain a bugbear to the million, and their use be unpopular, if not almost impossible, in practice." He cannot, however, have thoroughly considered the subject in proposing the introduction of three such minute coins as the *twenty-fifth*, the *fiftieth*, and the *hundredth* of a penny, for the purpose of overcoming the difficulty. If Mr. Smee would but fairly examine my proposal of coining the *fifth* of a penny, he would perceive that no smaller coin would be necessary, and even the 1·20th of a penny would be payable by merely interchanging the new coin with a farthing. I have shown, in previous numbers of the *Journal*, that this will accord with the adoption of either the *hundredth* of a pound or the *twelfth* of a pound, as a decimal unit.

I remain, Sir, your obedient servant,

S. A. GOOD.

H.M. Dockyard, Pembroke Dock, June 16, 1856.

REMARKS ON MR. HAWES' THEORY OF SAPONIFICATION.

In a paper read by Mr. Hawes, upon the 26th of March, and published in your Journal of the 28th of that month, some startling theories upon saponification were brought forward, the tendency of which aim at nothing more or less than the annihilation of the theory of Chevreul and his followers; the profoundness and correctness of which, I should have believed would have been deemed indisputable.

As some outline of the views advanced in the paper in question had been detailed to me by Mr. Lewis Thompson some years back, and being occupied at that time, as I have been pretty much since, in experiments upon saponification and saponaceous compounds; this, with the vital importance of the question to manufacturers, together with the scientific interest attached to the subject, was considered by me of such importance that I determined so fully to examine the question as at once to set at rest the correctness or fallacy of this view of the theory of saponification; and I shall now take the leading points of the new views as stated by Mr. Hawes, and give the results of my experiments connected with them, and also those of others where they bear upon the subject, and tend to elucidate what I feel to be the correct knowledge of the laws of saponification, which were first given to the world by Chevreul, and which no succeeding investigations have affected in any material manner.

Now, the first point I shall allude to, in which the results of my experiments place me completely at issue with Mr. Hawes, is the prevention of the production of glycerine by "combining the materials by mechanical means without the aid of fire, the object being to avoid the formation of glycerine." I must remark that, in this method of saponification nothing is really gained; glycerine, in the atomic proportion, is liberated; in fact, a similar reaction results as that brought about in the usual processes employed. Further, Mr. Hawes remarks, "at present from 8 to 10 per cent. of the fatty matter is converted into glycerine." This assertion I must compare with my own experiments upon this very important question, and I shall show that, in stating the above per centage, Mr. Hawes is also in error. Thus I found in four experiments that 100 parts of tallow, in its ordinary condition, when perfectly saponified by caustic soda in the usual manner, and the soap decomposed with great care by very dilute sulphuric acid, the fatty acids thus obtained, perfectly dried and weighed, gave, as a mean result, 94·5 per cent. One more experiment, more recently performed, with the greatest attention to accuracy, in which palm oil was employed, gave the following result:—14,000 grains of oil gave 13,212 grains fatty acids, which, calculated for 100 parts, gives—

Fatty acids	94·38
Glycerine liberated	5·62
	100·00

The ley contained in these cases, in addition to the glycerine, an inconsiderable amount of gelatinous matters, always the case when crude fatty matters are saponified, and which is of course included in the above 5·62, and therefore reduces the per cent. amount of glycerine still less. Again, Duffy (*Quarterly Journal of the Chemical Society*, vol. v., p. 305) found that the purest stearine furnished by saponification 95·59 of fat acid, a result which

I consider perfectly agrees with the above experiments, allowing for the crude state of my fatty matters; and from experiments I conclude that the amount of glycerine obtainable from the various fatty bodies in all cases, is very constant in per cent. amount. After all, these experiments are merely repetitions of those first made by Chevreul, which they fully confirm, and whose accuracy on these particular points cannot, I think, be called in question.

The next statement of Mr. Hawes, when he says that 1,540 lbs. of tallow are required to produce one ton of soap, is equally erroneous; and it is so for this reason:— The mean result of the analysis of ten specimens of soap made from tallow gave the per centage of fatty acids as 62·5, and the result of analysis of many hundred specimens enables me to fix this quantity as the constant amount of fatty acids existing in soap of that kind. Now, it is obvious that if 100 parts contain 62·5 of fat acids, one ton will contain 1,400 lbs.; but, as I have shown that 94·38 of fat acids represent really 100 of natural fat or tallow, it follows that 1,400 lbs. fatty acids is equivalent to 1,483 lbs. tallow, and that, consequently, this is the amount of tallow required to produce one ton of soap. If, again, the tallow really lost 10 per cent., as assumed by Mr. Hawes, then, by his own acknowledgment that soap contains 1,400 lbs. fat acid in one ton, his calculation that 1,540 lbs. would be required is also erroneous, as it is clear that the actual quantity must not be 1,540 lbs. but 1,555· lbs.

For 90 : 10 : : 1400 : 155·5 1400+155 = 1555·

Where Mr. Hawes speaks of the 1,300 lbs. of tallow being represented in the 1,400 lbs. of fat acids, I confess I can scarcely follow his chain of argument; but the results of the experiments I am now going to adduce will, I trust, render any further consideration of that reasoning unnecessary.

These results may be embodied under two heads. I find, first—That the amount of soap produced from fatty materials by saponification, irrespective of time or treatment, is unvarying and constant, and that the constitution and quantity of the soap itself, from corresponding fatty materials, never varies. That is, 66·22 of tallow or neutral fatty matters produce 100 of soap, thus represented:

		Representing		in 100
Fat acids	62·50	Fat acids ...	62·50......	94·38
		As glycerine	3·72......	5·62
Soda	6 50			
Water	31·00			
	100·00		66·22	100·00

Secondly,—That after perfect saponification, and decomposition of the soap by stronger acids, on renewed saponification, no more glycerine is obtainable from these fatty acids, their weight remains constant throughout such treatment, after the first saponification.

I shall remark, finally, with regard to the surmise of Mr. Hawes, that if sodium amalgam were triturated with tallow, and water carefully added, no glycerine would be produced, the experiments of Duffy have shown that glycerine is eliminated under far more improbable circumstances, namely, by acting upon stearine with a solution made by adding alcohol to sodium. Then, again, the fact of a strong caustic ley being found difficult to combine with fatty acids, simply proves that the affinity of the alkali for the water is so great as to retard its reaction with neutral fats. Yet there is no difficulty in producing saponification under these circumstances, with proper well-understood precautions.

I look in vain for the importance ascribed by Mr. Hawes to these phenomena, and cannot perceive in the results any one point otherwise than reconcilable with the theory of Chevreul. And the experiments I have just now mentioned prove beyond any possibility of a doubt that saponification is not an irregular and variable oxidating effect, produced by the action of caustic soda on fatty matters, and which irregularity might be obviated altogether, as contended by Mr. Hawes, but it is a definite chemical reaction, perfectly in agreement with the laws of chemical decomposition and combination, and in all cases uniform in its conditions.

Certain experiments I wished to make in connection with this subject have delayed my communication somewhat late.

I am, &c.,!
ALFRED ANDERSON, F.C.S.

Soap Works, Southwark, May 30, 1856.

BAROMETRIC ANEMOMETER.

Sir,—I believe the Society of Arts have offered a premium for an improved anemometer. I therefore beg respectfully to present the following scheme for their consideration and approval. The apparatus I propose to call a Barometric Anemometer. I think it promises very great accuracy in its indications, and at the same time is comparatively simple in its construction. It will be best described in two portions, viz., the external apparatus, or that which is exposed to the wind, and the internal, or indicating apparatus.

1st. On the top of any convenient building I would place a vane in the form of a funnel, mounted upon a hollow spindle, which should pass through an air-tight collar, or stuffing-box, into a small closed chamber, the spindle having a hole in the base opening into the chamber from which a pipe would lead to the indicating apparatus, which could be placed in any convenient part of the building. The vane should be balanced and arranged to turn freely horizontally, and present the mouth of the funnel towards the point whence the wind is blowing. The mouth of the funnel should be, at least, I think, a square foot in area.

2nd. The indicating apparatus I propose to use consists of two barometer tubes of about, say forty inches length, very carefully filled with mercury, and then inverted in two glass cisterns of mercury of very large area. One of these barometric tubes and cisterns I propose to enclose at the base with an air-tight glass chamber, into which chamber the pipe conducting the air from the vane should be inserted, and I anticipate that the varying force of the wind would be shown with great precision by the rising and falling of the column of mercury. The other barometric tube and cistern should be covered with a glass shade at the base to prevent any draught or current of air acting upon the mercurial column, but, at the same time, having an aperture to allow free communication with the external air. These two barometric tubes having been adjusted to agree with each other when under similar conditions (that is under the ordinary pressure of the atmosphere), the connection is to be made by the conducting pipe between the closed chamber at the bottom of the vane spindle and the closed glass chamber of the barometric tube. The pressure or force of the wind will then be shown by the difference of the heights of the columns of mercury in the tubes. I imagine it will give indications of the *lightest* wind. I propose dividing the tubes on the outside into inches and tenths of inches, to be read off by verniers sliding on the tubes. Forseeing some difficulty in adopting any adjusting apparatus for difference of level of the mercury in the cistern, I propose using cisterns of *large* area, that the difference or error may be as slight as possible. I think these would be best of a concave form, that would admit the inside being worked on a convex surface, or tool, to insure great uniformity of capacity. The barometric tubes should also be carefully selected with uniform bore. The best length for the tube must be determined by experiment. Thermometers should be placed in the cisterns of each barometric tube, to show any difference of temperature that may occur.

This apparatus could be made self-registering by adapting Mr. C. Brookes invention, now used for most meteorological instruments, and if thought desirable, a light train of wheel works could be connected with the spindle of the vane, so as to show the direction in which the wind is blowing.

I think this apparatus might be very easily arranged for use on board of ships, the barometric tubes being placed in the cabin of the vessel, and the vane (which possibly could be reduced in size for this purpose) on the deck, or any convenient part of the rigging a flexible tube being used for connecting with the indicator. Where scientific accuracy is not desired, a vane fitted up in connection with a barometric tube and closed chamber could be arranged with a stopcock in the connecting tube between the vane and barometer, and another stopcock placed in the closed chamber by means of which the air would be allowed to act upon the mercury in the usual manner. By this plan an observation could be made of the height of the column of mercury when exposed to the pressure of the wind from the vane, and another when the pressure was shut off by the stopcock in the connecting tube, and the ordinary height shown by opening the stopcock in the chamber of the cistern. The difference of the heights would give the pressure or force of the wind.

These are the principal details of my invention, which I have endeavoured to place before our Society as clearly as I am able in the absence of drawings. Should I have failed in being sufficiently explicit, I shall be most happy to give any further information that may be desired.

Yours, &c.,

RICHARD WILLATS.

28, Ironmonger-lane, Cheapside, London, June 12, 1856.

Proceedings of Institutions.

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Dover.—The twentieth annual meeting of the Museum and Philosophical Institution was held on the 7th ultimo, at the Guildhall Rooms. The report of the Committee, read by Mr. Phillips, (one of the secretaries), commenced by congratulating the members on the favourable condition of the Society, especially on its financial aspect, and on the success of the subscription set on foot at the last annual meeting for liquidating the debt of £60, £41 having been collected, which, with a saving in newspapers from the abolition of the stamp, &c., and by retrenchments during the last year, had enabled the committee to pay off nearly the whole of the debt. The attendance at the reading-room had been very large, from the interest excited by the late war. The library had received no augmentation by purchase. A splendidly bound volume, entitled "The Natural History of Braemar and Deeside," with illustrations, had been presented by H. R. H. Prince Albert. Some Government Reports, and a few valuable pamphlets from the Society of Arts, with the bound periodicals, constituted the only additions. The issues during the year for perusal stood thus: books, 469; periodicals, 97; newspapers, 537. There had been 13 lectures delivered during the session, 6 scientific, 5 literary, and 2 musical; they stand as under—Rev. S. Robins, M.A., "Books;" J. Brent, Esq., Jun., F.S.A., "Lyrical Poetry;" Mrs. C. L. Balfour, "On Celebrated Women, living at Times of Great Revolutions, in England, America, and France;" Rev. M. Woodward, M.A., "On the Chemistry of Water;" Peter Spencer, Esq., "On the British Poets;" Mr. Lane, F.C.P., "On Crowds;" Herr Schultsee, "On Music;" Mr. Mockett, "On Experimental Chemistry;" Mr. F. Warr, "Astronomy;" Mr. A. Bottle, "Electricity;" Mr. E. Wheeler, "On the Philosophy of Heat;" and Mr. J. R. Mummery, F.L.S., "On Marine Natural History." One conversazione had also taken place, "On the Restoration of the Maison Dieu Hall, Dover." The Museum had been enriched in all its departments, and the visitors to it had been constant and very numerous during the year. The report then stated that the committee had received circulars from the Society of Arts, London, respecting the proposed examinations, in different branches of knowledge, of members of the associated institutions, the particulars of which the members have been made acquainted with from the circulars themselves, which had been laid on the reading-room table. The committee regretted no classes had been in operation, with the exception of the French classes. There was a slight increase in the number of members, 40 having been admitted, against 30 who had left the Society: total number, 170. The treasurer presented his report, which showed only a small balance against the Society. The report having been approved and adopted, the election of officers and committee for the ensuing year was proceeded with, when the Mayor of Dover for the time being was elected President of the Institution; Vice-Presidents, Dr. Baird and Mr. Poulter; Curator, Mr. John Friend; Secretaries, Mr. Phillips and Mr. Bottle, in the room of Mr. R. Rees, resigned; Treasurer, Mr. John Mummery; Librarian, Mr. H. Crow; Guardian of Apparatus, Mr. R. Rees. L. Stride, Esq., was elected on the committee, in the room of Dr. Baird, appointed Vice-President; and in room of the six gentlemen of the committee going out by rotation, G. T. Thompson, Esq., J. C. Ottaway, Esq., and — Barton, Esq., were elected, and the Rev. John Briggs, A. Penny, Esq., and J. R. Mummery, Esq., re-elected. Mr. Charles Gordon was re-elected Exhibitor of the Museum, and the proceedings then terminated with a vote of thanks to the chairman, J. Poulter, Esq.

Liverpool.—At the end of May two lectures on the extinct Animals of the Ancient World were delivered, by Waterhouse Hawkins, Esq., at the Collegiate Institution.

MEETINGS FOR THE ENSUING WEEK.

Mon. Society of Arts, 12, Conference of Representatives of Institutions in Union.
Geographical, 8½, 1, Mr. W. D. Cooley, "Central Africa." 2, Dr. Livingston, "The Longitude of the Auango." 3, Capt. Becher, "The Landfall of Columbus." 4, Capt. Spratt, "Route between Kusherjé and the Danube." 5, Mr. Henry Poole, "Journey in Nicomedia and Palestine."
Tues. Society of Arts, 4½, One Hundred and Second Anniversary Dinner, at the Crystal Palace.
Med. and Chirurg., 8½.
Zoological, 9.
Wed. Society of Arts, 4, Annual General Meeting.
Microscopical, 8.
Royal Society of Literature, 8½.
Thurs. Numismatic, 7, Anniversary.
Fri. Philological, 8.
Sat. Royal Botanic, 3½.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 12th June, 1856.

Par. No.
249. Cheese—Account.
250. Hereditary Pensions Redemption—Account.
261. Wine and Spirits—Account.
262. Vessels and Tonnage, &c.—Return.
264. Appellate Jurisdiction (House of Lords)—Lords Report.
170. Bills—Medical Profession (as amended by the Select Committee).
171. Bills—Annuities Redemption.
169. Bills—Appellate Jurisdiction (House of Lords).
Cape of Good Hope (Kaffir Tribes)—Further Papers.
Public General Acts—Cap. 20, 21, and 22 (Delivered on 11th June).

Delivered on 13th June, 1856.

213. Holyrood Park—Correspondence.
257. Copper, &c.—Account.
260. Constabulary (Ireland)—Treasury Minutes, &c.
276. St. James's Park—Estimate.
277. War with Russia—(Vote of Credit for the late War).
172. Bills—Stock in Trade Exemption.
173. Bills—Tithe Commutation Rent-Charge (as amended by the Select Committee).
Sound Dues—Correspondence.

Delivered on 14th and 16th June, 1856.

259. Education—Minutes of the Committee of Council.
267. East India Pensions—Return.
269. Forest of Dean Central Railway Advance—Correspondence.
265. Nawab of Surat Treaty Bill—Minutes of Evidence.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette June* 13*th*, 1856.]

Dated 6th March, 1856.

564. Thomas Tisdall, Reynoldstown-house, Dublin—Improvements in machinery or apparatus for propelling steam vessels.

Dated 8th May, 1856.

1085. Alexander Alliott, Park, Nottingham—Improvements in drying apparatus.

Dated 10th May, 1856.

1106. Joshua Binns, Dukinfield—Improvements in machinery or apparatus for winding, sizing, and beaming yarns.

Dated 20th May, 1856.

1188. George Wilkinson, 17, Evans-street, Poplar—Improvements in steering apparatus, and in giving motion to machinery for raising and moving weights.

Dated 22nd May, 1856.

1221. William Churchill Dempsey, 4, Liverpool-street, King's-cross—A compound for removing all obstructions of the air passages.

Dated 24th May, 1856.

1245. Adam Dunin Jundzill, 18, Portugal-street, Lincoln's-inn fields—Instrument for animating stereoscopic figures.

Dated 26th May, 1856.

1251. Andre Adolphe Gaget, 39, Rue de l'Echiquier, Paris—Improvements in bookbinding.

Dated 27th May, 1856.

1268. Alfred Vincent Newton, 66, Chancery-lane—Improvements in reaping machines. (A communication.)

Dated 28th May, 1856.

1270. Lemuel D. Owen, Southampton-street—Improvements in the manufacture of artificial stone. (A communication.)

1271. John Macdonald, 13, Henry-street, Upper Kennington-lane, Vauxhall—Improvements in the reflection, emission, and radiation of light and heat for lamps, lighthouse apparatus, and other useful purposes.

1272. Joseph Clark, Buckskin Farm, Basingstoke—Improved horse hoe.

1273. William Fulton, Glasgow—Improvements in preparing and spinning fibrous materials, and in machinery or apparatus employed therein.

1274. Charles Herbert Holt, Manchester—Improvements in steam-boilers, furnaces for the same, and apparatus connected therewith.

1275. George Bell and George Charles Grimes, 1, Vauxhall-walk—Improvements in the manufacture of frictional matches and fuzees.

1276. Richard Archibald Brooman, 166, Fleet-street—Improved coating or composition to be applied to substances in order to render them uninflammable, and in the method of and apparatus for manufacturing the same. (A communication.)

Dated 30th May, 1856.

1278. Herman John van den Hout, Covent garden—Improvements in the preparation of pulp for the manufacture of paper, millboard, and other like purposes.

1279. Alexander Drew, Glasgow, and Matthew Gray, Bonhill—Improvements in weaving.

1280. Donald Bethune, Cambridge-terrace, Hyde-park—Improvements in apparatus for dyeing.

1281. William Carr Hutton, Sheffield—Improvements in stamps or hammers worked by power.

1282. John Weems, Johnstone, N.B., and John Henderson McCrindell, Glasgow—Improvements in the manufacture or working of metals and their ores.

1283. Frederick Luke Stott, Rochdale, and Thomas Belward and James Findlow, Manchester—Improvements in machinery or apparatus for washing wool or garments, and other articles made of textile fabrics.

1284. John Harris Heal, 196, Tottenham-court-road—Improvement in hair and wool mattresses.

Dated 31st May, 1856.

1285. Adolphe Bouvallet, 39, Rue de l'Echiquier, Paris—Improvements in printing woven fabrics, velvet, skins, and other like materials.

1286. Francis Alton Calvert, Manchester—Improvements in machinery for opening, cleaning, and carding cotton and other fibrous materials.

1287. Alfred Watson and Alfred Hamlyn Williams, Cornhill—Improvement in bottles, flasks, and other like receptacles for liquids.

1289. Fennell Allman and Donald Bethune, Cambridge-terrace, Hyde-park—Improvements in apparatus for separating fluids from solids, or for separating the more fluid particles from the more solid of various bodies.

1290. Henry Bessemer, 4, Queen-street place, New Cannon-street—Improvements in shaping, pressing, and rolling malleable iron and steel.

1291. Robert Jobson, Wordsley—Improvements in apparatus for making moulds for casting metals.

1292. Henry Bessemer, 4, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

1293. William Gossage, Widnes—Improvements in the manufacture of certain kinds of soap.

1294. Daniel Spink, Bridgwater—Improvements in rails and railways.

1295. Capt. Francis Fowke, R.E., Pall-mall—Improved portable photographic camera.

Dated 2nd June, 1856.

1296. Robert Blackwood, senr., Kilmarnock—Improvements in machinery or apparatus for doubling yarns or threads.

1298. Thomas Wilson, Birmingham—Improvements in screw-wrenches.

1300. Stephen Rossin Parkhurst, New York—Improvements in paddle wheels for steamboats and vessels.

1301. Bennett Johns Heywood, Leicester-square—Improved construction of holder for leads and other marking materials.

1302. Louis Auguste Dieudonné, 35, Essex-street, Strand—Improvements in nose bags. (A communication.)

1303. Auguste Cadet, 36, College-street North, Camden-town—Improved stamp inking apparatus. (A communication.)

1304. Augustin Marie Herland, Paris—A new regulator pen-holder.

1305. Victor Jean Baptiste Mauban, 39, Rue de l'Echiquier, Paris—Improvements in the manufacture of cans for holding oils and other liquids.

1306. James Edward McConnell, Wolverton—Improvements in locomotive engines.

1308. James Nasmyth, Patricroft, and James Brown, Newport, Monmouth—Improvements in apparatus for the manufacture of tin plates.

1309. Joseph Groley, Paris—Improved plough.

1310. Edward Marsden, Hanley-wood, Derby—Improvements in inplements for pulverizing and cleaning land.

1311. William Beadon, Otterhead, Honiton—Improvements in agricultural implements for cleaning, cultivating, and rolling land.

Dated 3rd June, 1856.

1313. Thomas William Willett, 89, Chancery-lane—Improvements in the manufacture of gunpowder.

1314. George Josiah Mackelcan, Islington—Improvements in the manufacture of rollers adapted to calico and other printing.

1315. Edwin Heywood, Sutton-cross-hills, Leeds, and Thomas Ogden Dixon, Steeton, near Keighley—Improvements in the means of attaching drawer and other knobs or handles.

1316. Christian Rudolph Wessel, 25, Fitzroy-square, New-road, and Francis Xavier Kukla, 3, Raven-row, Mile-end-road—A vapourless glow-heat disseminator.

1317. Joseph Bauzemont, Paris—Improvements in purifying turpentine.

1318. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in oil cans employed in lubricating machinery. (A communication.)

1319. Walter George Whitehead and Frederick Augustus Harwood, Birmingham—Improved candlestick.

1320. Jean Jacques Lebaillif, Falaise, France—Improvements in beating, cleaning, napping, and dressing cotton, wool, flax, tow, and other similar fibrous substances, and stuffs or woolles cloths.

1321. Raymond Fletcher, Derby, and Edwin Fletcher, Monk Bretton, York—Improvements in sweeping chimnies or other flues.

1322. Montague Richard Leverson, 12, St. Helen's-place—Improvements in tackle-blocks. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

Sealed June 13th, 1856.

2851. William Sangster.
2857. Frederick Robert Augustus Glover, M.A.
2868. Frederick Robert Augustus Glover, M.A.
2900. Myles Kennedy and Thomas Eastwood.
606. Christopher Duckworth and Thomas Marsden.

Sealed June 17th, 1856.

2845. Charles Bracegirdle.
2850. George Gotts Golding.
2862. David Lloyd Price.
2866. Edward Davies and John Milne Syers, and Charles Humfrey.
2878. Andrew Shanks.
2916. John Barton.
2936. Thomas Fielden Uttley.
1. Henry Truelove.
16. George Williams.
40. Francis William Gerish.
99. Adolf Pollak.
100. Edward Hammond Bentall.
264. Thomas Burdett Turton and John Root.
512. John Fowler, junr., and David Greig.
584. James Mills.
592. John Fowler, junior.
798. George Gwynne.
830. Arnold Morton.
840. William Edward Newton.
842. Arnold Morton.
850. Alexander Charles Louis Devaux.
854. John Brooke.
860. George Frederick Morrell.
900. George Tomlinson Bousfield.
902. William Fuller.
910. John Henry Johnson.
916. John Henry Johnson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

June 10th.

1424. Christopher Nickels and James Hobson.
1442. Joseph Leon Talabot and John Davie Morries Stirling.

June 11th.

1456. John Elliott and John Brown.

June 13th.

1439. Joseph H. Penny and Thomas B. Rogers.
1472. Joseph Warren.
1478. Robert Lister.
1493. James Worrall, junr.
1530. Thomas Weatherburn Dodds.
1726. William Thorp.

June 14th.

1453. James Dilkes and Edward Turner.
1549. John Emanuel Lightfoot.

Journal of the Society of Arts.

FRIDAY, JUNE 27, 1856.

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FIFTH ANNUAL CONFERENCE.

The Fifth Annual Conference between Representatives from the Institutions in Union and the Council of the Society, was held on Monday, the 23rd inst., at the Society's House, in the Adelphi. The Rev. Dr. Booth, F.R.S., Chairman of Council, presided. The following members of the Council were also present:—Mr. Harry Chester, Vice-President, and Mr. T. Winkworth.

The following is a List of the Institutions represented at the Conference, and of the names of the respective representatives:—

Barnet, Institute	Mr. Steph. J. Baldock
Battersea, branch of Belmont (Vauxhall) Mutual Improvement Society	Mr. J. Witham
Bexley Heath, Society for the Promotion of Useful Knowledge	Mr. Flaxman Spurrell
Birmingham, Messrs. Chance's Library and Reading Room	Mr. F. Talbot
Boston, Athenæum	Mr. Jas. W. Bontoft
Brighton, Athenæum	Dr. Williamson
Bristol, Athenæum	Mr. E. Halsall
Bromley, Literary Institute	Mr. Shillcock
Burton-on-Trent, Literary Society	Mr. John Matthews
Carmarthen, Literary and Scientific Institution	Mr. David Morris, M.P.
Croydon, Literary and Scientific Institution	Mr. William S. Masterman
Deptford, Institution	Mr. David Bass
Greenwich, Society for the Acquisition and Diffusion of Useful Knowledge	Mr. David Bass
Hastings, Mechanics' Institution	Mr. John Banks
Hertford, Literary and Scientific Institution	Mr. John Marchant
Highgate, Literary and Scientific Institution	Mr. James Yates, F.R.S.
Holmfirth, Mechanics' Institution	Mr. John Hixon
Huntingdon, Literary and Scientific Institution	Mr. Robert Honey
Leeds, Mechanics' Institution and Literary Society	Mr. H. Gore and Mr. Thomas Wilson
„ Yorkshire Union of Mechanics' Institutes	Mr. Barnett Blake and Mr. Th. Wilson
Lewes, Mechanics' Institution	Mr. Henry Browne
London, Kingsland, Dalston, and De Beauvoir Town Literary and Scientific Institution	Mr. Walter Rowton
„ London and South Western Railway Literary and Scientific Institution	Mr. F. J. Macaulay
„ London Mechanics' Institution	Mr. Saml. Vallentine
„ Royal Polytechnic Institution	Mr. J. C. Buckmaster
„ Tailors' Labour Agency Literary Institute	Mr. J. A. Dunn
Loughborough, Literary and Philosophical Society	Mr. John Spanton
Lynn, Conversazione and Society of Arts	Mr. Henry Edwards
Morpeth, Mechanics' Institution	Mr. Matthew Soulsby
Oldham, Lyceum	Mr. W. J. Fox, M.P.
Plymouth, Mechanics' Institute	Mr. E. Lane
Poole, Town and County Library and Literary Institute	Mr. E. Kemp Welch
Portsmouth and Portsea, Literary and Philosophical Society	Mr. R. G. F. Smith
Reigate, Mechanics' Institution	Mr. T. Martin
Romford, Literary and Mechanics' Institution	Rev. W. Taylor Jones
Shelton, Pottery Mechanics' Institution	Mr. Smith Child, M.P.
Sidmouth, Institution	Mr. W. T. Radford
Wakefield, Mechanics' Institution	Rev. W. R. Bowditch
Wandsworth, Literary and Scientific Institution	Mr. Paul Blackmore
Winchester, Hants & Wilts Adult Education Society	Hon. and Rev. S. Best
„ Mechanics' Institution	Mr. Henry Huggins
Yarmouth (Great) and Southtown Young Men's Institute	Rev. A. Bath Power, M.A.
York, Institute of Popular Science and Literature	The Lord Mayor of York (Mr. James Meek, jun.)

The Chairman called upon the Secretary to open the proceedings by reading his Annual Report to the Council.

Mr. P. Le Neve Foster then read the following Report:—

To the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—The fifth annual Conference being at hand, it is my duty to lay before you the principal matters in which you have been engaged during the past year, in reference to the Union of Institutions. One of the subjects brought before the last Conference, and urged upon the attention of the Council, as specially required to facilitate the working of classes in Institutions, was the bringing out text-books, adapted for the use of members of such classes. Much consideration was given to this point; but it was found that to make any attempt of the kind would only be of little value, inasmuch as already text-books were numerous, and it was thought that greater service would be done the Institutions, if those books already published could be brought more readily within the reach of those requiring them. The Council, therefore, determined at once to endeavour to obtain from the Committee of Privy Council on Education, in favour of classes in Institutions, the same reduction in the purchase of books and educational apparatus as is now granted to schools under inspection. A deputation, consisting of Mr. W. Ewart, M.P., the Rev. Dr. Booth, F.R.S., Chairman of Council; Colonel Sykes, F.R.S., Mr. G. F. Wilson, F.R.S., Mr. Winkworth, and the Secretary, accordingly waited upon Earl Granville, the President of the Privy Council, and the result has been that their Lordships have been pleased to assent to the Society's request, and grant the privilege to Institutions where classes of a scholastic character are established. In granting this privilege the Committee of Privy Council have laid down the following conditions, viz.:—

That the secretary of the Institution should, in each case, correspond directly with the Committee of Council, but with the application he should file a certificate from the secretary of the Society of Arts, stating that the Institution is in union with the Society of Arts, and that the Council of the Society recommends its application, it being understood, that no classes will be recommended to the Committee of Council except those in which regular instruction is the characteristic feature; that the classes will be open to the visits of her Majesty's Inspectors; that, if scientific apparatus be applied for, a competent lecturer will be engaged, *i.e.*, that the class will not depend for its scientific instruction upon itinerant lecturers alone; lastly, that the premises and furniture will be reasonably convenient for the purpose.

The lists, both of elementary school-books and of scientific apparatus, are at this time undergoing revision, for the purpose of being greatly extended. The revision of the lists is a work of some labour, and will not, probably, be completed for some time, and the Committee of Council do not think it will be advisable to admit this new class of cases until the new lists are completed and in use. The old lists would much more restrict the power of selection, and they have therefore requested that, at present, no steps be taken by the Council of the Society in the matter. As soon as the lists are completed, the Lord President will cause the Society to be informed that the Committee is prepared to receive applications.

The Council of the Society have urged upon the Committee of Council the great importance of these lists being quickly completed, and it is hoped that, in a few months from this time, the Institutions will be able to take advantage of the privilege. As connected with this topic, I may mention that correspondence has been received, in which it is suggested that the Council of the Society should urge upon the Committee of Privy Council on Education, the importance of assisting the Institutions with duly qualified class teachers. This, it is thought, might be done by the Committee of Privy Council granting to certificated teachers, when employed in class teaching, the same certificate allowances as they would be entitled to if employed in schools. This, I apprehend, is a matter that the Council will be ready to take up, should the Conference express its wish to that effect.

At the last Conference it will be remembered that a very decided opinion was expressed by the representatives that, notwithstanding the doubts on the subject entertained by the Council, some attempt should be made to obtain an amendment in the law relating to the exemption of Institutions from local rates, and a resolution was passed, earnestly requesting the Council to take steps to procure an amendment of the law, and the Conference, at the suggestion of the Council, named some of their Representatives to be associated with a Committee of the Society, for preparing a Bill to carry out this object. Accordingly a Bill was prepared by counsel, under the superintendence of that committee, Mr. Hole and Mr. Traice, two of the members of it, having been communicated with in reference to the Bill; those gentlemen residing at Leeds, being unable to attend the meeting of the Committee.

It was thought that the object desired could be best obtained by getting rid of the word "exclusively" used in the existing Act. By the Bill it is therefore simply proposed to repeal the clause in the existing Act, and re-enact it, leaving out the word "exclusively." The Bill also goes to make the certificate of the barrister, and, or in the event of his refusing, and its being allowed on appeal, final, so long as the rules remain unaltered. This Bill has been taken charge of in the House of Commons by Mr. Hutt, Mr. Ewart, and Lord Stanley. It has, as is now well known, met with considerable opposition in the House. In consequence of that opposition its passing has been delayed. It will come on for discussion again on the 2nd of July, and it is recommended to the Institutions to use every exertion to obtain the assistance of their local Members of Parliament on the occasion. The Council will not fail to do all that lies in their power to get the Bill passed. It must, however, be remembered that the delay which the opposition has caused renders it doubtful whether, even if passed through the Commons, it will be in time to pass the House of Lords this Session. Previous to the introduction of the Bill into the House of Commons it was printed in the Society's *Journal;* communications on it were invited, but none were received. It is somewhat remarkable, looking at the great interest in the subject displayed at the last Conference, that no notice should have been taken of its provisions.

At the last Conference the importance of a catalogue of books fitted for the libraries of the Institutions was much urged on the attention of the Council, when it appeared that such a catalogue was in preparation as portion of a book about to be published by Mr. Traice, at the request of the Yorkshire Union of Institutions. This work has been submitted to the Council of the Society, who have with much pleasure given permission for the name of the Council, as sanctioning the work, to be placed on the title-page. The book, it is understood, is now ready for issue. It supplies not only the catalogue of books, but a great amount of other matter and information of value to the Institutions. The Council have resolved to present to each of the Institutions in Union a copy of this work.

In reference to the often discussed question of the Blue books, I would remind the Council that since the last Conference a serial work has just been commenced, entitled *Annals of British Legislation*, by Professor Leone Levi. In this work an abstract is given of all Parliamentary and other public documents, and thus to a very great extent is supplied that information, at a moderate charge, which it appeared to be the general wish of the Institutions at the last Conference to be put in possession of. During the past year, at the request of the Council, several Blue books have been presented to the Institutions, such as the 3rd Report of the Royal Commissioners for the Exhibition of 1851, the Report on the Re-organisation of the Civil Service, the Report of the Civil Service Commissioners, and others which it is unnecessary to particularise.

The subject of the List of Lecturers has, during the past year, received much attention from the Council, who carefully considered the various recommendations and suggestions made at the last Conference in reference to it. The List has now been published, and a copy has been sent to every Institution in Union, and it is believed that in the compact form, and on the principle now adopted, it will be found to be much increased in usefulness. I cannot do better than quote from the preface in order to show the principle adopted in its formation:—

> "It will be noticed that this list differs in several respects from the two which have preceded it. In the first place, an endeavour has been made to separate the professional from the amateur and gratuitous lecturers, by dividing the list into two sections of paid and unpaid lecturers. Secondly, representations having been made at the Annual Institutes' Conference, in July, 1855, that the lists, as previously formed, were not what they professed to be, comprising only selected lecturers, it was determined in this instance to depart from the plan hitherto followed—that of asking Institutions to "*recommend*" lecturers—and merely to request the names of any lecturers they might be aware of; so that the list should be, as far as possible, a complete directory, and a directory only. Institutions will therefore distinctly understand that the present list is not to be taken in any sense as a selected or recommended one. The Institutions whose names are annexed to any lecturer are simply added to facilitate reference and inquiry.
>
> "This list contains all the names recently returned by the Institutions, except where the lecturer has requested that his name might be omitted, or where no address was given. Circulars were forwarded to all those lecturers contained in the previous lists, whose names were not returned by the Institutions on the present occasion. Those of the latter class only have been inserted who replied to this communication.
>
> "Institutions will understand that, in the case of unpaid lecturers, as they are for the most part local, when they are asked to leave their own districts, expenses must always be offered."

In addition to the List of Lecturers, has been formed and printed with it, a List of Apparatus and Diagrams, adapted for the use of the lecturer and the class teacher. This List can do but little more than indicate where the apparatus and diagrams can be obtained, and at about what cost. It will be evident that the Society could not print in detail the catalogues of the different publishers, and even had this been done, purchasers would still have found it necessary to make inquiries of the respective makers. This List has been got together by the Council, in accordance with the desire expressed at the last Conference, and though necessarily, to some extent, incomplete, it cannot fail to be of assistance to those seeking information in this direction. The Conference will probably express their views as to how far it meets the wants of the Institutions, and will offer suggestions for its improvement. Before I leave this subject I may state that, in communications received from two of the Institutions in Union, it is suggested that a central depot of diagrams, models, apparatus, &c., should be formed, from whence the Institutions in Union might get them on paying the expenses of transit, and guaranteeing to pay for any damage, &c. This probably will form the subject of discussion at the Conference.

It will be remembered that one of the objects laid down on the original formation of the Union in 1852, was, "that the Institutions be assisted to become also places of systematic instruction, with systematic examinations, and certificates of the results of studies." This the Society has endeavoured to carry out by establishing a system of Examinations. The first Examination was held in the Society's rooms on the 10th, 11th, 12th, and 13th of this present month of June, under the direction of an acting Board of Examiners consisting of the following gentlemen:—

Mr. Ball, Mr. John Bell, Dr. Bernays, Rev. Dr. Booth, F.R.S., Professor Brasseur, Professor Brewer, Mr. C. Brooke, M.A., F.R.S., Professor Browne, Mr. James Caird, Dr. W. B. Carpenter, F.R.S., Mr. F. S. Cary, Rev. S. Clark, Rev. Dr. Elder, Rev. W. Elliot, Mr. Glaisher, F.R.S., Professor Henfrey, F.R.S., the Dean of Hereford, Mr. G. H. Jay, Dr. Bence Jones, F.R.S., Mr. J. C. Morton, Rev. A. Bath Power, M.A., Mr. F. R. Sandford, Professor Solly, F.R.S., Dr. Stenhouse, F.R.S., Rev. F. Temple, Professor John Wilson, F.R.S.E.

There were 52 Candidates. The subjects in which the Examination were held were as follows:— Mathematics, Book-keeping, Mechanics, Chemistry, Physiology, Botany, Agriculture, Geography, English History, English Literature, (including English Composition and Writing from dictation,) Roman History and Latin, French, German, and Free-hand Drawing in outline from objects.

All the candidates were tested by a preliminary examination in writing and spelling, and unless this examination was satisfactorily passed the candidates were not allowed to attend the other sections of the examination. Of the 52 candidates two only were rejected on this head. The Examiners have been much gratified to find that in the greater portion of the subjects the general standard of information disclosed is higher than had been anticipated. The Society's certificates are of three grades; the first for "Excellence," the second for "Proficiency," and the third for "Competency." The details, however, of the examinations, will be given in the Examiners Report. I will, therefore, only announce that the following certificates have been granted:—

IN MATHEMATICS.

Certificates of Excellence.

Charles Chambers,	Leeds Mechanics' Institution.
Benjamin Harrall,	,, ,, ,,
Edward Highton,	Leicester Mechanics' Institution.
Alfred Lister,	Leeds ,, ,,
W. Matthew Taylor,	Windsor and Eton Literary and Scientific Institution.

Certificates of Proficiency.

Robert Abbott,	Leeds Mechanics' Institution.
William Dawson,	Boston Athenæum.
Francis Ford,	Bury St. Edmunds Athenæum.
F. Marshall,	Crosby Hall Evening Classes.
Wm. Wheaten,	Leeds Mechanics' Institution.

Certificates of Competency.

John Smurthwaite,	London Tailors' Labour Agency Literary Institute.
James Ware,	Greenwich Society for Diffusion of Useful Knowledge.

IN BOOKKEEPING.

Certificates of Excellence.
(None.)

Certificates of Proficiency.
(None.)

Certificates of Competency.

Robert Abbott,	Leeds Mechanics' Institution.
Daniel Leggatt,	London Mechanics' Institution.

IN MECHANICS.

Certificates of Excellence.
(None.)

Certificates of Proficiency.

Robert Abbott,	Leeds Mechanics Institution.
James Scotson,	Greenwich Society for Diffusion of Useful Knowledge.
Samuel Chas. Tisley,	London Mechanics' Institution.

Certificates of Competency.

Charles Chambers,	Leeds Mechanics' Institution.
William Dawson,	Boston Athenæum.
Alfred Lister,	Leeds Mechanics' Institution.
Daniel Leggatt,	London Mechanics' Institution.

IN CHEMISTRY.

Certificates of Excellence.

James Scotson,	Greenwich Society for Diffusion of Useful Knowledge.
William Shepard,	London Mechanics' Institution.

Certificates of Proficiency.

A. J. Austen,	Belmont Mutual Improvement Society.
Arthur Clarke,	Crosby Hall Evening Classes.

Certificates of Competency.

Alfred Lister,	Leeds Mechanics' Institution.
John Jones,	Reigate Mechanics' Institution.
Charles Aspull Wells,	Lewes Mechanics' Institution.

IN PHYSIOLOGY.

Certificates of Excellence.
(None.)

Certificate of Proficiency.

Henry Shorthouse,	Crosby Hall Evening Classes.

Certificates of Competency.
(None.)

IN BOTANY.

Certificates of Excellence.
(None.)

Certificates of Proficiency.
(None.)

Certificate of Competency.

Arthur Clarke,	Crosby Hall Evening Classes.

IN AGRICULTURE.

Certificates of Excellence.
(None.)

Certificate of Proficiency.

Joseph Pollard,	Hitchin Mechanics' Institution.

Certificates of Competency.
(None.)

IN GEOGRAPHY.

Certificates of Excellence.

Wm. Mat. Taylor,	Windsor and Eton Literary and Scientific Society.
Henry Wheeler,	Pimlico Literary and Scientific Society.

Certificates of Proficiency.

W. J. Alderson,	Liverpool Collegiate Institution.
James Burke,	Camden-town Literary and Scientific Institution.
Edward Highton,	Leicester Mechanics' Institution.
Alfred Lister,	Leeds Mechanics' Institution.
John Smurthwaite,	London Tailors' Labour Agency Literary Institute.
William Scott,	London Mechanics' Institution.
Arthur Thompson,	Great Western Railway Literary and Scientific Institution.

Certificates of Competency.

John H. Corr,	Crosby Hall Evening Classes.
M. H. Cromartie,	Wandsworth Literary and Scientific Institution.
Thomas W. Downes,	Pimlico Literary and Scientific Institution.
John Hams,	Romsey Library and Reading Society.
Benjamin Harrall,	Leeds Mechanics' Institution.
James Ware,	Greenwich Society for the Diffusion of Useful Knowledge.

ENGLISH HISTORY.

Certificates of Excellence.

Edward Badham,	Crosby Hall Evening Classes.
Henry Ball,	Belmont Mutual Improvement Society.
William Scott,	London Mechanics' Institution.
James J. Shaw,	,, ,,
James Spencer,	Greenwich Society for Diffusion of Useful Knowledge.
William Matthew Taylor,	Windsor and Eton Literary and Scientific Society.
Arthur Thompson,	Great Western Railway Literary and Scientific Society.
James Ware,	Greenwich Society for Diffusion of Useful Knowledge.

Certificates of Proficiency.

Robert Abbott,	Leeds Mechanics' Institution.
W. J. Alderson,	Liverpool Collegiate Institution.

James Burke,	Camden Town Literary and Scientific Institution.
Charles Chambers,	Leeds Mechanics' Institution.
Edwd. Geo. Clark,	Crosby Hall Evening Classes.
Elvery Dotbie,	Ipswich Mechanics' Institution.
Edward Highton,	Leicester Mechanics' Institution.
George Hume,	Ipswich Mechanics' Institution.
Alex. Macdonald,	London Mechanics' Institution.
F. Marshall,	Crosby Hall Evening Classes.
John Smurthwaite,	London Tailors' Labour Agency Literary Institute.

CERTIFICATES OF COMPETENCY.

John H. Corr,	Crosby Hall Evening Classes.
M. H. Cromartie,	Wandsworth Literary and Scientific Institution.
J. R. Evans,	Crosby Hall Evening Classes.
EdmundHutchinson,	Sheffield People's College.
John Pulling,	Crosby Hall Evening Classes.
Henry Wheeler,	Pimlico Literary and Scientific Institution.

ENGLISH LITERATURE, &c.

CERTIFICATE OF EXCELLENCE.

Edwd. Geo. Clark,	Crosby Hall Evening Classes.

CERTIFICATES OF PROFICIENCY.

James Burke,	Camden Town Literary and Scientific Institution.
F. Lynch,	London Domestic Mission Society.
James J. Shaw,	London Mechanics' Institution.
James Spencer,	Greenwich Society for Diffusion of Useful Knowledge.
James Ware,	„ „ „

CERTIFICATES OF COMPETENCY.

Francis Ford,	Bury St. Edmunds Athenæum.
Alex. Macdonald,	London Mechanics' Institution.
William Scott,	„ „

IN ROMAN HISTORY AND LATIN.

CERTIFICATES OF EXCELLENCE.

(None.)

CERTIFICATES OF PROFICIENCY.

James Burke,	Camden Town Literary and Scientific Institution.
John Pulling,	Crosby Hall Evening Classes.

CERTIFICATES OF COMPETENCY.

Edward Highton,	Leicester Mechanics' Institution.
Edmund Hutchinson,	Sheffield People's College.
F. Lynch,	London Domestic Mission Society.
Thos. Mirehouse,	Crosby Hall Evening Classes.
Thos. Widdows,	Hitchin Mechanics' Institution.

IN ROMAN HISTORY ALONE.

CERTIFICATE OF EXCELLENCE.

(None.)

CERTIFICATE OF PROFICIENCY.

(None.)

CERTIFICATE OF COMPETENCY.

Arthur Thompson,	Great Western Railway Literary and Scientific Institution.

IN FRENCH.

CERTIFICATE OF EXCELLENCE.

Edward Steele,	Crosby Hall Evening Classes.

CERTIFICATES OF PROFICIENCY.

Edward Badham,	Crosby Hall Evening Classes.
J. R. Evans,	„ „
Thomas Howard,	„ „
F. Lynch,	London Domestic Mission Society.
John Pulling,	Crosby Hall Evening Classes.
Wm. Shepard,	London Mechanics' Institution.
Thomas Widdows,	Hitchin Mechanics' Institution.

CERTIFICATES OF COMPETENCY.

James Burke,	Camden Town Literary and Scientific Institution.
George Hume,	Ipswich Mechanics' Institution.
John Smurthwaite,	London Tailors' Labour Agency Literary Institute.

IN GERMAN.

CERTIFICATE OF EXCELLENCE.

Thomas Howard,	Crosby Hall Evening Classes.

CERTIFICATES OF PROFICIENCY.

(None.)

CERTIFICATES OF COMPETENCY.

Robert Abbott,	Leeds Mechanics' Institution.
John Pulling,	Crosby Hall Evening Classes.
Edward Steele,	„ „

IN FREE-HAND DRAWING IN OUTLINE FROM OBJECTS.

CERTIFICATES OF EXCELLENCE.

(None.)

CERTIFICATE OF PROFICIENCY.

Robert Slingsby,	Lincoln Mechanics' Institution.

CERTIFICATES OF COMPETENCY.

(None.)

The following are recommended by the Examiners for Prizes:—

IN CHEMISTRY.
Ten Guineas to James Scoteon.

IN GEOGRAPHY.
Ten Guineas to Henry Wheeler.*

IN ENGLISH HISTORY.
Ten Guineas to James Spencer.

IN ENGLISH LITERATURE, &c.
Ten Guineas to Edward George Clark.

IN FRENCH.
Ten Guineas to Edward Steele.

IN GERMAN.
Ten Guineas to Thomas Howard.

FOR GENERAL EXCELLENCE IN THE EXAMINATIONS.
Twenty-five Guineas to Wm. Matthew Taylor.*

For the Inland Revenue appointments the following have been recommended:—
Robert Abbott and Charles Chambers.

In my report to the Council, which was read to the Conference last year, an account was given of the holding of the Society's Educational Exhibition in St. Martin's Hall, and of the determination of the Government, at the request of the Society, to establish such a collection as a permanent National Museum of Education. The Institutions will be glad to learn that the Royal

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* The Board of Examiners had, at their first meeting, awarded the prize in Geography to Wm. Matthew Taylor. They had some difficulty in deciding between the claims of Wm. Matthew Taylor and Henry Wheeler, but as the Council, on the recommendation of the Board of Examiners, have awarded the Society of Arts prize of twenty-five guineas, for *General Excellence in the Examinations*, to Wm. Matthew Taylor, who obtained three certificates of the highest grade in Mathematics, Geography, and English Literature, the Geography prize thereby is again placed at the disposal of the Board of Examiners, who award it to Henry Wheeler.

Commissioners for the Exhibition of 1851 have, with the assistance of a pecuniary vote of £15,000 from Parliament, commenced the erection of a building on the Commissioners' estate at Kensington Gore, where the Museum of Education and other museums will be suitably and publicly displayed. The Trade Museum, jointly collected by the Royal Commissioners and the Society of Arts, under the charge of Professor Solly, and which the representatives at the last Conference had an opportunity of visiting, displayed temporarily in the Society's rooms, has, during the past year, become the sole property of the Royal Commissioners, who have undertaken to set apart in the above-mentioned building suitable space for its reception and display, with a view to its future increase and full development as a National Industrial Museum.

It has hitherto been customary to state the amount of books purchased by the Institutions during the year under the arrangements for discount made by the Society; this year, however, I am unable to do so, inasmuch as under the plan now adopted and detailed in my last report, the whole of the money part of the transaction takes place directly between the Institution and the publisher, and the Society has, therefore, no account of the sums which are paid. The book orders are now supplied from day to day, and the experience of the year shows that the plan has worked well. I have no reason to think but that as large an amount of books has been purchased during this year as during former years, and probably more. During the year, a great number of Institutions have had the loan of the Society's collection of Photographs, Chromo-lithographs and other objects of interest which the Society has been enabled to obtain for them. To the collection of photographs, has lately been added a series of engravings or etchings by the new process, termed "Photogalvanography," as it is named by its inventor, the etched, or engraved copper plates being produced directly by the agency of light and electricity, a marvellous development of the photographic art. In addition to these, there has been circulated with the Society's collection a series of bronzes, kindly furnished by the Council of the Art Union. The reports from the Institutions show a general spirit of activity pervading their management, tending to increase their sphere of usefulness, and if in some cases their funds are not so promising as their supporters could wish, there certainly seems no reason to despond. A number of earnest men are engaged in their promotion, and day by day that number is increasing. A truer appreciation of the objects of such Institutions, and of the means by which those objects are to be obtained, is gradually awakening. The true meaning and end of education is becoming more widely understood. Science is no longer considered the sole privilege of philosophers, but its principles are now admitted to be of every-day application to the ordinary affairs of life, and the necessary ingredients in the teaching of our youth. The true aim and end of science is, as Lord Bacon wrote three hundred years ago, "to enrich human life with useful arts and inventions."

I am, Gentlemen,
Your obedient servant,
P. LE NEVE FOSTER,
Secretary.

The Secretary then read the following list of subjects which had been suggested for discussion:—

I. The Society's Examinations.
II. List of Lecturers, &c., including Diagrams and Apparatus.
III. Female Education.
IV. Trade Schools.
V. Bill to amend Exemption Act.

The Chairman said—For the fifth time we are assembled in this room to hold converse together on subjects which do not, perhaps, yield in importance to any other that we could be called upon here to discuss. We assemble here to day with some advantages over our earlier meetings; our objects are better defined. We have learned to know what is practicable, and what is impossible; what we may hope some time or other to accomplish, and what we can never effect. We have come, too, to know one another better; to discern our respective aims more clearly. While we have learned to appreciate the good feeling displayed, the strong common sense shown, and the valuable suggestions thrown out by you so often in this room; on the other hand, you have come to know us better; the suspicions which so many harboured at first have been dispersed; the belief has grown upon you that we have no covert objects behind, that we do not seek to cramp your independence, or to fetter your freedom of action. On referring to the original memorandum drawn up by Mr. Chester, and placed before the first Conference, I think you will find that nearly all those things we professed ourselves willing to undertake we have at least attempted to carry out. In some we have been successful; if others were above our strength, or beyond our reach, or fenced round with difficulties we could not remove, we are not much to blame, seeing how very often the legislature itself is foiled, how very frequently the Government is compelled to give way. Of the manner in which this day's discussion is to be conducted I have only two remarks to make. One is, that we adhere to the five minutes' limit upon speakers—a regulation which has been found to work remarkably well here, as it would, no doubt, elsewhere. The other is more important, that gentlemen will adhere to the subject under discussion, and not mix up lectures with examinations, or discuss diagrams and female education together. The first subject on the list is that of examinations, as it is the one of the greatest importance before us this day for discussion. And if you will permit me to advise you, I would suggest to you the utility of turning the discussion into the channel, how examinations may best be extended over the country, rather than how the Society of Arts ought to conduct theirs; because I can assure you, in the name of the Council, that no aids which experience can suggest, or ample funds supply, will be wanting to render our system as perfect as we can make it. Now, there are two plans we may follow. We may, like the Committee of Council, send down sealed papers to the different localities, and have the examinations conducted on the same day all over the country; or we may establish Local Boards of Examiners, to hold preliminary or test examinations. Now, the Council, in their reply to the Liverpool Mechanics' Institution, have stated their objections to their former plan; with your permission, I will read our Secretary's letter to them.* But there are other objections. The Society's examinations would be conducted in privacy or obscurity, and six months after the examination the successful candidate might obtain through the post his crumpled and stale certificate. Besides, independently of this, it has always been the policy of our Society in its action with the associated Institutions, to aid and supplement, not to supersede their action. Now, I have no hesitation in saying that without their cordial and continuous co-operation we cannot succeed. Through their co-operation we can make it a success; and having made it a success, we at once reflect upon the Institutions all the benefits of this scheme—we fill their classes, and we bring their educational advantages before the public. I would throw out the following suggestions for the formation of District Boards of Examiners in union with the Society of Arts:—

I. That the Mechanics' Institution of a populous town, when large, or the several smaller Mechanics' Institutions of the same district, shall group themselves together with a view to the establishment of Local Boards of Examiners.

II. That the managers shall endeavour to obtain the assistance of qualified persons to act as Examiners, chosen from the clergy, the ministers of various denominations, the professional men, and other like qualified persons.

III. That the Local Boards, when so chosen, shall elect a Chairman and Honorary Secretary, who shall place themselves in communication with the Society's Board in London, so as to secure unity of action and uniformity of procedure.

IV. That the Local Boards shall hold their Examinations in the month of March.

V. That as soon after as may be the Local Boards shall report to the Society's Board the results of the Examinations, the numbers of Candidates who are to be sent up to the Society's Examinations in June, and the Subjects in which such candidates are to be examined.

VI. That in the month of July the Local Boards of Examiners shall call Public Meetings in their respective localities, and deliver, in the presence of their friends, neighbours, and fellow-townsmen, to the Successful Candidates, the Society's Certificates and Awards of Prizes previously sent down from the Society of Arts to be so distributed.

EXAMINATIONS.—HOW THEY MAY BEST BE EXTENDED OVER THE COUNTRY.

Mr. Barnett Blake (Yorkshire Union) said, representing, as he did, a union of Institutions existing under varied and different circumstances, he could state that the difficulties with regard to examinations applied to many of them in a very great degree. It might be quite competent for the Leeds Institution to hold local preliminary examinations, and to vote money from its funds for the purpose of sending candidates to London to compete for the certificates and prizes offered by the Society of Arts, but with regard to the great majority of the Institutions, they had no means with which to overcome the difficulties alluded to by the chairman in his opening address. In the great and populous district of Yorkshire, there were a large number of Institutions to whom the certificate of this Society would be of immense advantage, but owing to their great distance from London, where the examinations took place, it was almost impossible that members of those Institutions could participate in the competition for the Society's certificates of merit. He would suggest that one means of overcoming the present difficulty would be the establishment of an itinerant board of examiners, and that the examination should be conducted in some central spot in each district, by men whose certificates would carry value, from the high reputation in which the Society of Arts was held throughout the country. The local Institutions, he thought, would have great difficulty in obtaining examiners from amongst their respective bodies; and upon the subject of examinations generally, he thought the committees of Institutions required a stimulus quite as much as the members of those Institutions. It was quite true, in the great object which had been projected by the Society of Arts, a great deal of its usefulness and success must depend on the exertions of the local committees of Institutions, and to this end a stimulus was required. It was not enough in the present day to say that "virtue has its own reward." They were dealing with a class of men in whom the country at large had a considerable interest. They were dealing with a class of men who required to know that in devoting their attention to the study of any particular branch of science or literature, they would have a positive and tangible appreciation of their abilities in the certificates awarded by the Society, which would be of advantage to them in their after progress in life, and which should be a lasting testimony of their abilities and be promotive of their future interests. The question which he wished more particularly to bring under notice was, whether the Society of Arts could not, with the powers it possessed, instead of holding the examinations year after year in London, send its examiners into Yorkshire or some central place in other large counties, where there were a large number of Institutions in existence, to sit for a day or two days, as required, in order to examine those candidates which the local Institutions had not the means of sending to London, but whom they might easily send to Leeds or some other central town for the purpose of examination, under the plan which he now ventured to suggest. The Union which he represented embraced 130 Institutions, and there were many others not yet in union in the same county. He, therefore, thought the subject of itinerant examinations was one worthy of consideration.

The **Hon. and Rev. S. Best** (Hants and Wilts Adult Education Society) said, he, like the gentleman who had just spoken, represented an aggregation of societies—including nearly 100 village educational associations,—and he went with that gentlemen to the extent of his observations with regard to the impossibility, even if a portion of the expenses were paid from extraneous sources, of sending up candidates to undergo a three days' examination in London. Even if they could get over the difficulty of expense, a further and still more formidable one remained, viz., that employers would not allow their servants so long an absence from their duties; and he was sorry to add, that his own experience in this matter was anything but favourable to the employers, who he had not found ready to make any sacrifices in order to allow the young men in their service to come up to London for the purpose of examination. Therefore, if they could get over the difficulty of the expense, there remained still the insuperable difficulty of persuading employers to allow those in their employ, from clerks down to the intelligent mechanic and agricultural labourer, to come up to London and devote the requisite time to the examinations instituted by the Society of Arts. Thus circumstances which they could not control prevented full advantage being taken of the Society's intentions in this great matter.

The **Lord Mayor** of York (Mr. James Meek, jun.), representing the York Institute of Popular Science and Literature—said, as the representative of one of the Institutions alluded to by the gentleman who spoke first he begged to say, the subject of itinerant examinations was one which possessed his own thoughts. It appeared that there were insuperable obstacles in the way of the effectual and practical working of the system of examinations, if the candidates were obliged to come all the way to London for that purpose. In addition to the expense, there was an objection on the part of parents to their sons being launched upon a large city like London; and with regard to the grouping of Institutes into districts, the same objections would apply to a minor extent. For instance, if the Yorkshire and a number of other Institutions were formed into a Leeds district, the same objections would exist, although in a less degree. If an itinerant board of examiners could be organised, even if it involved contributions from the particular Institutions asking for the attendance of the examiners, he thought that would be the practical way of attaining their object, and in districts where no candidates offered themselves the examiners would have no occasion to attend.

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* See *Journal of the Society of Arts*, ante, page 318.

Mr. H. Gore (Leeds Mechanics' Institution and Literary Society) supported the suggestion of Mr. Barnett Blake, and coincided in his views as to the practical impossibility of the examinations being general, so far as the less favoured and distant Institutions in Union were concerned. With regard to the large Institution which he represented, he would mention that the committee found a difficulty in meeting the requirements of their candidates, regard being had to the amount of funds at their disposal. There were other pupils whom they would have been glad to have sent, but it was impossible to raise the necessary funds for that purpose. That which applied to the larger Institutions applied with greater force to the majority of the Institutions in the country; whereby the parties whom they most wished to benefit were placed under circumstances of the greatest disadvantage. They had four or five other candidates who were anxious to be examined for the Society's certificates, but they could not ask them to be at the expense of residing four or five days in London, in addition to the railway fares. They could not hope the pupils would do so; it would be asking them to do a positive injury to themselves and their families to undertake such a journey under such circumstances, and the funds of any single Institution must be in a very prosperous condition to enable it to bear all the expenses attendant upon sending up three or four candidates for examination. He thought the suggestion of itinerant examinations was not attended with all the difficulty that might appear at first sight, because there were a great many Institutions that could afford to pay a small fee towards the expenses of the Board of Examiners. At all events, he thought the experiment might be ventured upon in some central town, either in Lancashire, Yorkshire, or Staffordshire, appointing a spot at which persons in the district might assemble at small expense both of time and money, and, at the same time, contribute in a great measure toward the expenses of the Board of Examiners. The next important question was, how far it would be practicable to limit the members attending the Society's examinations. Preliminary examinations by a central local board could be instituted, and a prize worth contending for in such local examinations might be the payment of the expenses of such as most distinguished themselves, to enable them to compete in the examinations to take place in London. That appeared to him to be the only way of meeting the case, and even then, the operation of the examination must be necessarily restricted, for it was impossible that the Institutions themselves could bear the expenses of the journey of three or four of their members to attend the examinations in London, and this remark more especially applied to that description of persons whom they more particularly wished to have the benefit of the advantages offered by the Society of Arts.

Mr. Harry Chester (Vice-President) said—Circumstances of a domestic nature had prevented him taking any part in the active proceedings of the Society for a considerable period; he therefore came to the consideration of this subject quite as unbiassed by any recent acts of the Council as any one present representing the Institutions in Union. He was at a distance of a thousand miles from England at the time the Council came to the determination to alter the character of the examination from written questions in the several departments to oral examination. There could be no doubt that the two different plans of examination would produce different results; but he thought the great thing to be looked to was, as far as possible, to combine the advantages of both. They had heard that the Society had given up the plan of paper examinations. On hearing this he felt sorry, because he knew the effect would be to narrow the range of the examinations, and that an advantage would be given to the larger and richer Institutions over those less favourably situated, for the reasons which had already been adverted to. But when he came to see how the thing was to be worked, and how it had worked, he felt convinced that what had been done was of the greatest value in the matter of public education. He thought it would be a misfortune if they were compelled to give up the plan adopted this year. He thought one important object to be effected was to encourage the formation of local unions, in order to work out the preliminary portions of the business. He thought it quite impossible that the Society of Arts could send out boards of examiners into different towns; because the Society did nothing in this matter except through the most distinguished men that were to be got, and he should be sorry to reduce the value of the diplomas granted; and if the plan of travelling boards of examiners were adopted, they must necessarily be deprived of the services of those eminent men whose co-operation it was so desirable to secure. If the travelling board did not visit almost every town of importance, the objections which had been mentioned would still exist. It was as difficult to travel now-a-days twenty or thirty miles over a cross country as it was to travel two hundred miles by railway to London. At the same time, he admitted that the expense on the part of the more remote Institutions of sending up candidates for examination occasioned an almost insuperable difficulty; and in this respect, perhaps, the Society of Arts might see its way to doing something more than it had yet done; and to this end he hoped some more active steps would be taken towards the organisation of local preliminary examinations. He did not attach so much importance as the Council seemed to do to the difficulty of avoiding copying and unfair proceedings with examinations conducted on paper, spread simultaneously over a large extent of country; but he thought the difficulty might be diminished by the Society deputing an officer of its own appointment to preside over the examinations in certain cases, which officer should be responsible for the fairness with which the examination was conducted. He agreed as to the great desirableness of the examinations taking place, as far as possible, in the places where the candidates gained their daily bread; and to such as gained first-class certificates in these local examinations the means might be offered as a premium to enable them to proceed to London to compete for the higher honours bestowed by the Society of Arts. He thought the Chairman, in his address, had omitted one important point; inasmuch as, in the plan he proposed for extending these examinations, he had omitted the functions of the Chancellor of the Exchequer; and when invitations were given to persons to be examined, the means must be provided for them to attend. They could not move from the places in which they resided without being pecuniarily assisted. He (Mr. Chester) was therefore inclined to advocate the organisation of provincial unions and sub-unions; and by an extensive adoption of that plan, he thought funds would not be wanting in future to carry out the plan adopted by the Society. He thought there was scarcely an Institution in existence which could not contribute something towards bringing the advantages of this system to the people of their own locality.

Mr. James Yates, F.R.S. (Highgate Literary and Scientific Institution), thought preliminary local examinations would remove many of the difficulties pointed out as at present standing in the way of the object in view, in these examinations. By this means the number of candidates for the higher classes of examination might be reduced to such an extent as that means would not be wanting in the several districts for sending the most proficient pupils to London for examination. The preliminary applications could be sent in some time previously to the general examination taking place; and he did not see any objection to the Council of the Society deciding in proportion to the number of candidates offering themselves for examination, at what town or city in the district the preliminary examination should take place. At the same time he felt persuaded that there were other parts of the country, no less than in London, where they might have examinations conducted in the most satisfactory manner. Examiners might be sent from London, but he saw no absolute necessity for it, because he was satisfied that qualified examiners might be found in other situations. Take Manchester as one great centre; if they compared the population of the district forty miles round Manchester with the district forty miles round London, it was beyond all comparison greater and more important in point of population. He could not say what the proportion was; but he should say it was twice, and it might be three times, greater. But there was yet a still higher consideration. What was the state of intellectual activity, and the amount of general information, taking the comparison between the two districts? His own impression was, that the intellectual activity in the districts around Manchester would stand higher than in a similar extent of district around London; that is, taking all classes of the people—high and low; and he believed that a greater amount of general intelligence would be found to prevail in the large district of which Manchester is the centre, than in that of which London is the centre. They would find more applicants for examination from the Northern districts than from the Metropolitan districts. If they took Leeds as another centre, he believed the same results would be obtained; and the same might also be said of Glasgow. To refer to individual cases, he might mention that he lately received a printed list of subjects for examination from an educational establishment at Llandovery, in South Wales, and such a list he did not think would suffer from being placed before the heads of University College or King's College. He had also received similar papers from Southampton. In Carmarthen, likewise, examinations of a high grade were conducted. In Manchester they had Owen's College, with Professor Williamson and Dr. Franklin, and at its head men who stood high in rank in London and elsewhere. In Glasgow, also, there was a University of great eminence; all which facts were proofs that they ought not to give undue preference to London, as the intellectual as well as the political capital of the empire, so as to entirely exclude other portions of the kingdom from similar competition. He thought, if a plan could be originated by which these examinations could be conducted in certain districts, it would give a stimulus to those localities, and would reflect the highest honour upon this great Society.

Mr. Buckmaster (London Royal Polytechnic Institution) did not agree with all the arguments of the last speaker, with reference to examinations. If they increased the number of examiners, they would increase the difficulties of the examinations. He believed the work could be done better the fewer the number engaged in it. He apprehended there would be very little difficulty in carrying on a simultaneous examination in different places, if it were necessary; and if a hundred persons were ready to undergo examination in any particular district, and a time was appointed, let some one be sent from the Society of Arts, and let the responsibility of that examination rest upon that individual. He thought they did not require a great man for that duty, but one who was acquainted with what he had to do. Under such circumstances, the papers would be sent down from London at the same time, be given out to be worked in each district on the same day or days, and be then sealed up, sent to London, and examined by the Board in London, and the results of the examination could be published as soon as the papers were gone through. Of course, care must be taken that the papers did not ooze out, and thus he believed the examinations could be carried on as effectively as if they took place in that room. It was out of the question to think of examining 500 persons at the Society's house; and if they had to move, he apprehended the difficulty would be as great a mile from that place as if it were done 100 miles distant. He was quite sure that in particular districts they would find a hundred persons ready to undergo examination. To such let an officer be sent down, and let the same papers be sent into other districts. He was aware that difference of opinion obtained with regard to oral examination. Some persons would answer questions easier and quicker than others by oral examination; and a man might fail in oral examination who might succeed in paper examination. The test of oral examination was in the promptitude of the answer, whereas the examination by papers afforded more time for consideration; and, he thought, a man's attainments could be measured better by what he committed to paper than by what he answered off-hand. He was satisfied that there was no examination like a good paper examination, by which, he believed, they could get at results more correctly, and, therefore, he did not attach the value which some appeared to do to oral examinations, although they were very well if they could be properly carried ut.

The Rev. W. R. Bowditch (Wakefield Mechanics' Institution) said, in the case of the Society which he represented, they found it impossible to send up candidates to London for examination, and he could state that the principal of a *quasi*-public school in Wakefield was in a position to send up 13 or 14 pupils who, it was believed, would have passed the examination with distinction, but the means of sending them were wanting. The principal of the school told him, "They have no money, no influence, but they have plenty of brains and good education." This was the class of persons that the examinations were intended for, and he thought the only way of meeting the case was to send out examiners into the various districts. With all deference to the observations of the chairman, with regard to examinations by printed papers sent out simultaneously, he (Mr. Bowditch) begged to say that when, in accordance with the minute of the Committee of Privy Council on Education, printed examination papers were sent out in 1846, having officiated as an examiner of 86 pupils, not a single difficulty occurred in the mode of conducting that examination, and it was characterised by the most perfect fairness throughout. If they had local boards of examiners they would have to contend with the difficulty that each board would conduct the examination in its own way, and each examination would be different from another. The great object was to give stimulus to education. These examinations were valuable only as a potential instrument, impelling both masters and pupils to exert themselves more in time to come than they had done in time past. But then the necessity arose for examining every Institution in the country separately—seeing it in its every-day life, and not merely in its holiday clothes, and that could only be done by sending competent inspectors, going from place to place, and bringing back a report in each case.

The Chairman—Where are the funds to come from?

The Rev. Mr. Bowditch admitted there was the difficulty of the thing. He would express his own opinion that it was impossible to conduct examinations satisfactorily except as a department of the educational machinery of the country. The Society of Arts had initiated it well. It initiated the Great Exhibition, and it acted well in afterwards handing it over to the Royal Commissioners, and in like manner he should rejoice to see the plan of examination, which the Society had so well initiated, handed over to a department of the government. If that were found to be impracticable, he would suggest that the Society should adopt the plan of sending sealed papers throughout the country, as he did not think local boards of examiners would be found to work well.

Mr. John Spanton (Loughborough Literary and Philosophical Society) remarked, that local boards were apt to be influenced by local prejudices, and experience too often showed that such prejudices did exist, which would probably have more weight with those who were to be examined than with the examiners themselves. Another course was, however, open. Instead of appointing local boards by local agency, the Society of Arts might be able to find persons in different parts of the country willing to undertake the duty.

The Rev. A. Bath Power, M.A. (Great Yarmouth and Southtown Young Men's Institute), said, he appeared at this conference rather in the capacity of one of the board of examiners than as the representative of a Society, and he had, therefore, waited to hear the opinions of the various delegates present on this subject. There could be no doubt but that the attempt to assemble large numbers of persons in London for examination was attended with great practical difficulty. The board of examiners were quite aware of the fact that, but for the difficulties pointed out, the number of candidates at the late examination would have been considerably greater than it was, and numerous expressions of regret were received at the pressure of circumstances, to which allusion had been made. If it were not for the element which had entered into this discussion in reference to the desirableness of including oral with written examinations, he thought a great deal might be said in favour of examinations carried out upon a large scale upon the plan with which they were familiar as adopted by the Committee of Privy Council on Education. The mode in which those examinations were conducted, commanded the confidence of the country at large. There had never been a whisper of suspicion or doubt expressed but that the results arrived at through that machinery were perfectly satisfactory—as satisfactory, in fact, as any human machinery could make them. Having explained the system adopted under the plan of examination by papers, their mode of collection and transmission to the board in London, the reverend gentleman added, that he thought a machinery somewhat of the same character would be found to answer very well in the great object which the Society of Arts had in view, and the examinations might be conducted on somewhat similar principles. To that end, he thought it was not necessary to have an officer appointed by the Society, at great expense. Gentlemen who had rendered voluntary services in connection with the present plan of examination would, he thought, be happy, as far as possible, to lend their aid in carrying out subjects of a more comprehensive character. The papers sent out under the plan adopted by the Committee of Privy Council, might be received by this Society as the centre, to be placed under the charge of certain gentlemen for the purpose of examination in detail, as time and circumstances permitted. It might occupy a longer period than was the case in the late instance, but he thought the question of a few days or weeks in the publication of the results was a matter of small importance. The examinations by papers having been completed, promising candidates might be invited to attend an oral examination before the board in London—if oral examinations were thought so essential to the scheme. His own views, with regard to oral examination, corresponded very much with those expressed by Mr. Buckmaster. He had known instances in which, from accidental circumstances, candidates had suffered materially under that plan, and it struck him that if oral examination was to be carried out to any great extent, more time must be occupied on future occasions than was the case on the late occasion of the examinations. As it was, the examiners were somewhat embarrassed by the number of candidates. He would express his own opinion—founded not merely upon recent experience, but also upon that gained in connection with the operations of the Committee of Privy Council of some years' standing, that the employment of a similar machinery—admitting probably of some modifications—would be the best means of extending the advantages of those examinations over the entire surface of the country.

Mr. Chester said the mode of examination by papers was that which was proposed by the Council of this Society, and adopted by the Conference, two years ago; but when the Council came to apply themselves to the matter, they experienced the difficulties that had been mentioned in the communication with the Liverpool Institution, which had been read in the address of the Chairman that morning; and therefore the plan had been modified to the extent they had heard stated in the report of the Secretary. As far as regarded paper examinations, he thought it would be better to have the cream of the candidates brought up; and if the Society of Arts should continue in its present good financial position, he did not know any mode in which the funds could be better appropriated than in assisting to bring up a few well-selected individuals to compete for the highest honours of the examination.

The Chairman said the plan, as originally put forth in 1854, was before the country for two years, and during the whole of that period they had only two applications from parties to be examined. The Council of the Society, therefore, thought it necessary to modify the plan, and to take some other course in order to bring the matter fairly before the public. The result had been the number of candidates they had heard of.

Mr. Smith Child, M.P. (Shelton Pottery Mechanics' Institution), said—In the district which he represented there were many Institutions, but most of them so situated that they could not afford the expense of sending pupils to London for examination. In considering a scheme of this nature, they must not consider it abstractedly, but what was the most possible and practicable plan to be adopted. In looking over the list of young men who had received prizes and certificates in the late examinations, he found that they were all either from localities close to London, or from populous towns having large and rich Institutions; which showed, he thought, that the districts less favourably circumstanced were placed at a disadvantage in this honourable competition. It appeared to him that a modification of the plan detailed by Mr. Bath Power was the best that could be adopted—viz., to issue examination papers to the Institutes in every district under proper supervision; and upon the examination of these papers, or upon the certificates of merit awarded, they might eliminate from the great mass a certain number who might be brought up to London to compete for the superior orders of merit to be awarded by the Society of Arts.

Mr. William S. Masterman (Croydon Literary and Scientific Institution) suggested a plan of examination similar to that which was adopted in the case of candidates for admission as attornies. He expressed himself in favour of the more extended plan of examination by papers, considering that oral examinations, from their necessarily restricted operation, would not effect the end desired. He thought persons of talent, in every district of the country ought to have a fair opportunity of competing for the honours which were awarded by this Society.

Mr. Smith Child thought the directors of railways would grant free passes to candidates coming to London for examination.

The Chairman replied that the privilege had been refused.

Mr. Stephen Baldock (Barnet Institute) thought it desirable, if it could be carried out, that the chief examinations should take place in London. He thought, after the suggestions that had been thrown out, the several Institutions might meet the expense of sending a candidate or two to London by putting a small additional subscription upon each member.

The Chairman would remark that throughout this discussion it seemed to be implied that the Society of Arts had large funds at its disposal. That Society was a purely voluntary body, and it was to be recollected that educational examinations, however valuable, were only a part of the objects they carried out, and therefore he should hesitate to pledge the Society to any extraordinary amount of expenditure in the matter of the examinations. It was hardly proper to compare the operation of this Society with that of the Committee of Privy Council, who had unlimited funds at their disposal—their own body of organised officers to send round, and their own normal teachers to employ. The Society of Arts possessed no such organisation, and if they had they would be obliged to pay for it.

Mr. John Hixon (Holmfirth Mechanics' Institution) had listened with some apprehension to the suggestion that deputations of examiners from the Society of Arts should visit the Institutions in the country. If any considerable number of examiners were appointed it would be attended with great expense, and whether the Society would be able to meet that expense, was a matter which he had entertained with apprehension. Then, with regard to the expense of sending candidates to London for examination, he was afraid that would be attended with difficulty; and it was a grave question with him whether the managers of Institutions would be justified in appropriating the funds of the general body for the purposes of individual benefit and advantage. He thought the suggestion of sending one or two qualified persons to enter upon examinations in certain central localities was worthy of serious consideration. They could not but highly appreciate the exertions which the Society of Arts had made on behalf of the Institutions in Union; but he thought the subject of examinations was beset with considerable difficulties. With regard to oral examination, he attached considerable importance to it; for it might be that a pupil might commit something to paper which he could not explain upon oral examination.

Mr. Thomas Wilson (Leeds Mechanics' Institution and Yorkshire Union) remarked that one great good would have been effected if they were enabled to decide what was not practicable, even if they could not arrive at what was practicable. The discussion had, to a great extent, shown that central examinations, if intended to apply to the mass of those who in future years might present themselves, were impracticable by the means which any Institution had at present at its command, and he thought central examinations could only be carried out by a general measure, such as no voluntary society could undertake. He thought the difficulty of providing funds to send candidates to London for examination had not been over stated. It might readily be accomplished in the cases of Institutions situated within ten or twelve miles of London, but it could hardly be done at a distance of 200 or 300 miles. The Institution which he represented numbered some 2,000 members, and had a considerable annual income, but it was with difficulty that the Committee felt they could appropriate the small sum they did to sending a few of the pupils of their day schools and evening classes to London for examination. Mechanics' Institutes, like many other educational establishments in this country, were, for the most part, at the last gasp to find funds to go on with; and it was impossible to find money for any service involving a large expenditure. The only practical measure, he thought, was local examinations; and the question arose—not how that could best be done, but how it could be practically carried out with the means at present at their disposal. After considering all the suggestions that had been thrown out, he was afraid there was no other plan open to them than that adopted by the Committee of Privy Council on Education, the principal difficulty then being, that in the smaller Institutions they had not an organisation which would admit of that system being safely applied, inasmuch as they must have the certainty that such examinations were conducted with the strictest impartiality.

Rev. W. Taylor Jones (Romford Literary and Mechanics' Institution) said he felt a strong interest in this question, connected as he was with an Institution (the Royal College of Preceptors) which was endeavouring to carry out the same cognate measure, and by which examinations of young men, and pupils of schools, were carried on. The subject of the examination of private schools had been debated day after day in the Institution with which he was more particularly connected, and the only plan they could bring themselves to adopt was that which had been practised by the Committee of Privy Council on Education, viz., by printed papers and the appointment of proctors to be present during the examinations, to collect the examination papers and transmit them to the Board. As an examiner of some years' standing, and also as an examinee, he did not attach the importance some gentlemen had expressed to oral examinations. He had known persons pass a rapid oral examination which would not have been so satisfactory if it had been set to paper, whilst, on the other hand, he had known persons who could not undergo an oral examination, yet had passed most satisfactorily when the examination was conducted in a written form.

The Rev. Bath Power wished to state, in reference to what had fallen from the Chairman, that in the comparison of the Society of Arts and the means at their command with the Committee of Privy Council on Education, his idea with respect to sending examination papers to local centres was, in his opinion, the most economical that could be adopted. He knew of no other machinery which would embrace so large a sphere of action without incurring larger expense. There were centres of recognised educational movements to which the examination papers could be sent, and to the persons attending those examinations the expense and loss of time would be very small as compared with coming to London.

The Chairman remarked that the difficulty might be met by charging a small fee on the issue of each certificate, which was now furnished gratuitously.

Mr. Thomas Winkworth (Member of Council) remarked, that it resulted from this discussion that the Council of the Society could take no action upon this question, inasmuch as gentlemen differed in opinion, first, as to the relative advantages of oral and written examinations; secondly, as to means by which candidates could be subjected to either or to both; and, thirdly, as to the persons who should be the examiners. Supposing they had one set of examiners to go to one part, and another set of examiners to go to another part, it was clear if such a system were adopted it would not inspire confidence in those who were to be examined for the honours which the Society proposed to distribute. Therefore he would suggest, that as they had twelvemonths before them, an opportunity would be afforded of largely examining into the difficulties with which the question was beset, and he had no doubt that long before the period for the next examination, an approximation to something that would be satisfactory to all parties would be arrived at.

The Chairman said the discussion which had taken place would have the full consideration of the Council. He proposed that they should now proceed to the next subject on the list, namely,

The New List of Lecturers,

relative to which he would remark, that the list just issued had been printed he thought upon a better plan than formerly, and was intended as a directory for the use of the Institutions.

Mr. Blackmore (Wandsworth Literary and Scientific Institution) inquired whether it would not be possible to give more generally the terms of the professional lecturers.

The Secretary replied that it had been done as far as possible in the list just issued.

Mr. Blackmore also inquired whether it would not be possible to obtain a list of the teachers of Institute classes to be issued with the List of Lecturers.

The Chairman replied, no doubt it could be done on a future occasion, but he thought the number was so small and scattered that it would be of little service.

Mr. Blackmore added, that Institutions had frequently great difficulty in knowing where to seek for teachers of Institute classes.

Mr. Henry Huggins (Winchester Mechanics' Institution) said, the same difficulty had been experienced in the Institution which he represented. He suggested the practicability of Institutions in towns situated on one line of railway within easy distance of each other—such, for instance, as Southampton, Basingstoke, and Portsmouth, on the South-Western line—entering into an arrangement for the employment of the same teacher on different evenings of the week. He thought by such a plan an efficient instructor might be obtained in a manner economical to the several Institutions who associated for that object.

The Chairman said it was only open to the Institutions themselves to make an arrangement of that character. It was, of course, a matter into which the Society of Arts could not enter.

The Hon. and Rev. S. Best remarked, that such a proposition had emanated from Southampton.

Mr. E. Kemp Welch (Poole Town and County Library) inquired whether skeleton lectures could not be furnished for the use of those Institutions which could not afford to pay professional lecturers?

The Chairman replied that the plan had to a certain extent been adopted by the Working Men's Educational Union. It had been at one time proposed by the Society to issue manuscript lectures; but, as it did not meet with sympathy, the plan fell through. He believed one manuscript lecture was tried at an Institution, and failed.

Mr. E. Lane (Plymouth Mechanics' Institution) remarked that they were in great want of a popular and poetical lecturer on decimal coinage—(laughter)—and he was at a loss to know where to apply for such a one. He could promise a gentleman who would endeavour to enlighten his fellow townsmen on this subject a welcome reception and kindly entertainment in Plymouth.

The Chairman had no doubt Mr. James Yates could put the gentleman in the way of gratifying his wishes in that respect.

Mr. Yates, F.R.S., said the International Association for obtaining a Uniform Decimal System of Measures, Weights, and Coins, would be happy to furnish a lecturer. Although he could not promise a poetical treatment of the subject, still he thought the subject, properly handled, was not so dry as many supposed it to be.

Mr. R. G. F. Smith (Portsmouth and Portsea Literary and Philosophical Society) remarked that difficulty had been experienced in inducing other Institutions in the district to join in the engagement of lecturers; and the difficulty of provincial Institutions in selecting lecturers was enhanced by the list just issued containing no recommendation of such as had more particularly distinguished themselves in the subjects of which they treated. He wished to see a list from which they could not only choose themselves with confidence, but also recommend to their neighbours. He mentioned the difficulty he had experienced in endeavouring to associate Institutions for this object. Having himself occasion to make inquiries respecting a lecturer, he wrote to the officials of two Institutions; one of whom returned the answer that the person with respect to whom the inquiry was made was a most able and efficient lecturer, whilst the other stated that they had completely used him up. (Laughter.) He had been requested to make a suggestion that a central committee should be formed in London, of which the Society of Arts should be the head and directors; and that such committee should be a centre of communication between the lecturers and the Institutions; that such committee should be furnished with a certain amount of apparatus required for the illustration of scientific lectures, which might be purchased partly by government grant, and partly by contributions from such Institutions as were disposed to assist in the object; and also that this central committee should make arrangements for circuits of lecturers, to give regular courses of scientific lectures, in the place of the desultory system to which they were at present obliged to have recourse, even with the assistance of the published list of lecturers just issued. It was suggested that—say 400 Institutions should unite upon the matter of lectures; each Institution to subscribe £30 a-year towards engaging lecturers for the whole season. This would amount to a sum of £12,000, which would provide eighty lecturers, allowing to each £150 for the six months; and for such a consideration, the Institution he represented believed, gentlemen who devoted themselves to particular branches of science would undertake a circuit of the character he had described.

The Chairman would state, in reply to the gentleman who had just sat down, that this subject had been very extensively discussed by the Council three or four years ago. They had tried the plan on a small scale in the first instance, and even then found difficulty in carrying it out; and he might mention that Mr. W. Hughes, who was regarded as one of the most popular lecturers of the day, experienced the greatest difficulty in bringing even a few Institutions to co-operate for the purposes suggested. He was of opinion that no such plan could be successfully carried out; in fact, the representative had himself furnished the best answer that could be given on the subject in the statement he had just made—that even in two Institutions diverse opinions prevailed with regard to the abilities of a particular lecturer. How could they expect such a plan to succeed with a multitude of Institutions, and a host of lecturers? The Society of Arts could not undertake to do everything in behalf of the Institutions: they must have some freedom of action amongst themselves, and he thought they could not do better than inquire into the qualifications of the lecturers whom they contemplated engaging.

Mr. Gore would remark upon the question of apparatus, with which he had had somewhat to do, that he thought the Society of Arts might render important service to the Institutions by offering a premium for the production of a cheap set of educational apparatus, for a systematic course of instruction. To think of applying to the mathematical instrument maker for apparatus for popular illustrations of science was out of the question; they must be content to look for the aid of the cabinet maker and the carpenter in such matters. He was sure such a proceeding would be of great benefit to the Institutions, because a lecturer going a long distance could not take along with him the bulky apparatus which was essential for the illustration of his subject.

The Chairman called attention to the statement contained in the report of the Secretary relative to the plan proposed by the Committee on Education with regard to apparatus for the illustration of lectures, and he might mention that the Department of Science and Art at Marlborough House had proceeded in the same direction in the invention and preparation of scientific and other apparatus; and he believed such apparatus would shortly be supplied at prices which the Society of Arts could not hope to approximate.

Mr. Gore added that the Society had done good service to the cause of scientific education by the premiums they had offered for the colour-box and the microscope; and he thought good results would follow from a similar course being taken with regard to educational apparatus.

Mr. Chester alluded to the great superiority of the French cases of mathematical instruments. They could be bought as low as one franc, and up to ten francs. The first contained serviceable instruments, the latter complete and highly-finished articles.

Mr. Barnett Blake said, two years ago he brought before the attention of the Conference the subject of affording the more distant Institutions from large towns assistance in the matter of lectures; but the difficulty was how to diminish the expenses of the lectures to such Institutions. In the list now published there was nothing more than might be found in the circulars of the lecturers themselves, excepting the advantage of knowing where those gentlemen could be found. The advantage hoped for by the co-operation of the Society of Arts, was an arrangement for economising the expenses of lectures by means of circuits. That failing, the next best thing they could do was to give a list of those lecturers who required to be paid, and those who gave their services gratuitously in particular localities. With reference to the lectures themselves, he thought the most valuable were those which might be termed suggestive lectures—pointing out the future studies that members of Institutions should take: he looked to that rather than to the positive information conveyed in the lecture itself as a means of real good amongst these Institutions. With reference to apparatus, diagrams, and maps, he questioned whether any advantage would be gained by the formation of a depôt in London, except in the case of diagrams, which could be transmitted with facility from place to place.

The Chairman remarked, that no proposition for the supply of lecturers to the various Institutions could be entertained unless they were prepared to place the whole of their lecture arrangements, both as to time and subject, in the hands of the Society. Unless that were done, the Society could not move a step in the matter; and he very much questioned whether the Institutions would be disposed to enter into such an arrangement for the purpose of being supplied by them with lecturers.

Mr. Buckmaster said, lecturers must be distinguished from teachers. If they met with a good scientific teacher, he might be able to carry on a systematic course of scientific instruction in several Institutions in the same neighbourhood, but it was idle to suppose that a lecturer would travel about the country attached to no special place. He thought a man who was to be a teacher of science in these Institutions, ought to be responsible to some authority. If they could establish that authority, a man might attend several Institutions, and a good system of instruction would be guaranteed. With regard to apparatus, he would remark that a good lecturer did not want a great deal of apparatus: it was rather an impediment than otherwise, for illustrations were always at hand with which the audience was more or less acquainted. All they wanted was apparatus which would illustrate the elementary principles of science. So far as his own experience went, he would tell them he did not believe there were five-and-twenty persons in the whole country who were competent to undertake the systematic education of a scientific class with efficiency and usefulness. The Trade and Navigation Schools which were being established in the country might serve as centres. A school of that description had been established by Mr. Green, at Poplar. This was started with eighty men, who were engaged in the dock-yard all day, but they were, nevertheless, most regular and exemplary in their attendance upon the course of instruction provided for them, as an occupation for their evenings. An absentee was the exception. How was it that such schools succeeded? Because there was system and organisation, and there was a responsibility to head quarters on the part of the instructors in these schools. Without system and without organisation they could do nothing. He could say for himself, that he should hardly consider a "welcome reception" a sufficient remuneration for going to Plymouth to lecture.

The Chairman remarked that he did not see that either the furnishing of educational apparatus, or the supply of scientific teachers to Institutions, were matters that could be taken up by the Society of Arts. He admitted these were wants. He agreed with the last speaker in thinking that there were not five-and-twenty people, disengaged, who were qualified to teach scientific classes of Institutions. It was a want of the age.

Female Education.

The Chairman said this was a subject in which he had taken great interest. He might say it was at the base of all improvement in education. He begged to call upon Mr. Chester to state the practical results of a school with which he was connected, in which female education was particularly attended to.

Mr. Chester said this was certainly a subject in which he took a deep interest, and, having read a lecture of the Chairman's on the Industrial Education of Females, he begged to say he entirely concurred in the views expressed. He, however, thought this was a subject which barely came within the scope of the present Conference.

The Chairman.—It has been asserted elsewhere that my views are theoretic. I should, therefore, be glad to hear what has been practically carried out in the Industrial Schools at Highgate.

Mr. Winkworth remarked that the Society of Arts embraced a wide field of operation. They were not confined to Mechanics' Institutions. There were many Institutions of various kinds, which did not come under the category of Mechanics' Institutions, which were recognised by the Society; and therefore he thought the Conference might with advantage consider this subject, which had been placed upon the paper. He entirely agreed in the opinion expressed by Dr. Booth, in his interesting lecture on this subject, that there was a great difference between instruction and education. The one was received from the teacher, the other from the parents.

Mr. Barnett Blake considered that the Conference could hardly entertain a subject of greater importance than this; and he believed it was in the power of Mechanics' Institutes to do important service in this matter in the various localities in which they were situated. There could be no doubt that upon female education rested a very considerable portion of the social and moral welfare of the industrial classes of this country; and therefore it was of the highest moment that a proper education should be imparted to those who were hereafter to fill the office of wives and mothers. He could point to a gentleman (Mr. Hixon) who had taken an active part in this matter in his own locality, and who had experienced no difficulty in getting ladies of his district to volunteer their services as teachers; and in other quarters, where attention had been paid to the subject, they had been in a great measure successful. If it were more generally taken up, he was convinced that it would largely contribute to the comfort and well-being of those around them. He believed the absence of home employment for females—especially in the manufacturing districts—was the source of much misery and evil. Females were attracted from their homes to earn wages in factories, until they lost sight altogether of the ordinary offices of domestic life. Mr. Blake proceeded to state the plan which had been introduced by a large manufacturer of Huddersfield, of inducing females to attend classes of instruction in plain needlework (in which, he said, the females of the manufacturing districts were frequently very deficient), under the attraction of interesting tales being read to them whilst they were employed in needlework. That plan had been found highly successful.

Mr. Chester fully admitted, that there was no subject of greater importance than the proper training of the wives and mothers of the industrial classes; but he would repeat, that he thought it was one which hardly came within the scope of the present conference to entertain. The object of this conference was, to make it useful to the Institutions, to afford increased facilities for carrying out their objects. The Chairman had been so vigorous and so successful a promoter of education, and had grasped with so strong a hand the reins of the Society of Arts during the period of his present office, that he (Mr. Chester) felt great reluctance in declining to comply with the request he had made; but he thought the interests of the Institutions in Union would be best promoted and preserved by keeping to the subjects which properly came within their sphere.

The Rev. Mr. Bowditch considered the subject of female education closely connected with the promotion of the usefulness of Mechanics' Institutions. He thought it of the greatest importance that instruction in the duties of domestic life should be added to the other teaching of females—such as needle work, baking, cooking, &c. The waste in a poor man's house from ignorance on such matters was enormous, and he could take them to houses of the working classes where every bit of needle work was put out and paid for.

Mr. Yates mentioned that in Liverpool there was a girls' school in connection with the Mechanics' Institution, and he was sorry there was no representative present from that place.

A general wish having been expressed that Mr. Chester should favour the conference with a statement relative to the schools at Highgate,

Mr. Chester proceeded to state, that at Highgate they had the ordinary National Schools for boys and girls, and infants of both sexes, and also a very good British School. The enlargement of the National School having become necessary, after much debate and opposition in the parish, it was determined to build new school rooms rather than enlarge and patch up the old buildings. The sum of £8,000 was expended in the purchase of 4½ acres of freehold land, and the erection of large school-houses for boys and girls, and infants—together with lavatories and other appurtenances, besides three houses for the teachers. A spade-husbandry farm was provided for the boys, where they were instructed both in the theory and the practice of the cultivation of the soil, rotation of crops, &c., the management of a cow, bee keeping, the rearing of pigs, poultry, and rabbits, in which great interest was taken by the boys. As a reward of merit, a portion of ground was allotted to be cultivated for the benefit of the boy or that of his family. The spade husbandry farm had become self-supporting. The children were kept out of the streets. Twelve girls were boarded in the school, and, with others, were fully trained in cooking, washing, dairy and laundry work, making bread, cutting out and making clothes, and in general household work. The results were most satisfactory. After this training, the girls went out to service, and proved most efficient and valuable servants.

Mr. J. W. Fox, M.P. (Oldham Lyceum), thought this was a subject of too great importance to be entered upon at the fag end of the meeting; he was, nevertheless, obliged to Mr. Chester for the interesting statement with which he had favoured them. He thought there were various ways in which the Society might direct attention to this portion of female education, and he was glad to hear that the prizes offered by Lord Ashburton for "common things," included premiums to both sexes. They were apt to make too broad a distinction between the educational development of males and females. This Society might do good in the encouragement of classes for female education. He saw no reason why females should not compete for the honorary certificates awarded by the Society; for they might depend upon it, the better a female was educated, the more the female intellect was developed, the better qualified was she to fulfil the high and important functions of domestic life for which she was destined. They had seen a remarkable instance of the influence of well-educated women in the ladies who undertook the mission of Crimean nurses; and he hoped efforts would be made by the Institutions generally, to add classes for female education to their other objects of usefulness. He looked to this as a means of enlarging the sphere of female employment, and opening out other modes of obtaining a livelihood than the factory. To promote such an object would confer honour upon this Society, and would add to the many acts of usefulness which it had already accomplished.

Mr. Hixon gave some details of the operation of classes for female education in Holmfirth, the results of which, he said, were highly satisfactory. He urged the Institutions to take up this subject.

The Chairman expressed his acknowledgements to Mr. Chester for the valuable information he had given relative to the schools at Highgate, which went to prove that it was practicable to realise what he (Dr. Booth) had stated in theory.

Trade Schools.

The Rev. Mr. Bowditch remarked, that a system of instruction with a view to the pursuits of after life, was the only thing which deserved the name of education. The old triplet—reading, writing, and arithmetic, were soon forgotten, if not cultivated with some ulterior object of usefulness; but where they were carried out to potential results, as in the case of the schools at Wandsworth and other places, those acquirements were the more diligently laboured for under the consciousness of the necessity of their application to their future wants in life. He instanced the beneficial working of such schools in his own parish in Wakefield, where the population of the lower classes, from being a byeword and a reproach, had come into habits of industry and order.

Mr. Buckmaster remarked that he was connected with one of the first Trade Schools established in this country. The children who for the most part attended those schools, were not those taken from the ordinary National and British schools, but those of the better class of artizans and small tradesmen; and if there was one class more neglected than another, it was the class just named. With the exception of the College of Preceptors, the education of the middle classes of the country had been greatly neglected. Everything had been done for the two extreme ends of the lever; in the first case for the university class, and in the other case, for the very poorest class. With regard to the education of the working classes of this country, if it was to be of value at all, it must have reference to the practical affairs of every-day life; if not, it would certainly fail in its results. There were subjects with which all mechanics ought to be acquainted,—mensuration—practical geometry; and there were other subjects in which special classes ought to be instructed—chemistry and the elements of mathematics; and for the most part, they would find that these special teachings would have reference to the particular occupation which most obtained in the various localities. Boys ought to be made acquainted with the tools and appliances with which they would hereafter have to deal, and with the principles of the machinery with which they were to be brought into contact. He believed the trade schools were calculated to supply a deficiency which had hitherto existed. They had not as yet received the support and consideration to which he thought they were entitled from the public departments of the country. He felt that in course of time these schools would be found valuable aids to Mechanics' Institutions. To educate a boy properly, they must instruct him in that which he felt would be useful to him when he was grown up. When the Wandsworth Trade School was first started, they had only 15 pupils; now they had more than 100, out of a population of 9,600, and that without any special local circumstance or peculiarity to recommend it. Wherever there was a population of 1,500, with a person of energy, he believed the thing could be carried out, and when that was effected, such schools might be made supplemental to Mechanics' Institutes.

Mr. **Gore** said—Feeling the necessity for an improved system of artisan education, he thought it behoved the Mechanics' Institutions to look more than they had done to the development of these practical classes. In a recent visit to the Continent, witnessing the improvements which had taken place within the last seven or eight years in the mechanical and manufacturing powers of the people, he was led to seek the cause of it. It was evident to him there was something underlying the surface; and he had no doubt but that the whole resulted from the more perfect system of elementary education which the artisan there received. He looked upon this question as vitally connected with the manufactures of the country, and that our artisan population should be better educated in the use of the tools and machinery which they employed. He illustrated his argument by the statement of the results of instruction of a class of gas-makers in Leeds in the principles of the manufacture. Two years ago the manufacture of 11,000 cubic feet of gas was considered a fair day's work for a man: but at the present time they made 18,000 feet each per day, with the same material, and with less trouble than formerly they made the 11,000 feet. If education were carried into the manufactory and the workshop, the employer would be benefitted, because labour would be used to the greatest advantage; there would be less waste of material, and the results would be obtained with greater certainty.

Mr. **Lane** said he saw matter for great hope in these Trade Schools, and he felt it was a step in the right direction. Education must always have an upward tendency; it raised a man from the ranks of his own class to a rank above, till he reached the summit of the social ladder. The great evil at the present time was that they did not find mechanics in their Institutions; but let them bring the impulse of utility and growing power to bear, and they might hope to see the development of education from the lower truth to the higher truth.

RATING OF INSTITUTIONS.

The **Chairman** said this could hardly form the subject of discussion on the present occasion, inasmuch as the Bill in Parliament would come before the House again on the 2nd of July. He would therefore suggest to the members of Institutions—seeing the opposition which had been given to the Bill—the necessity of "putting the screw" upon their respective representatives in Parliament to obtain their support to the Bill. He also urged upon them to petition the legislature on the subject without delay. He called attention to a form of petition adoped by the Bristol Athenæum, which he thought was very much to the purpose.

Mr. **Halsall** (Bristol Athenæum) stated that the form of petition had been sent to 300 Institutions. He thought it was matter of regret that no notice had been taken of this Bill in the last few publications of the Society, which led him to fear a lukewarmness upon the subject.

The **Chairman** remarked that the pledge given by the Society to prepare a bill on this subject, and submit it to Parliament, had been carried out to the strictest letter, and in perfect good faith. Objections to the Bill were raised in the House, when Mr. Hutt withdrew it, in order to have it re-committed. If there were any chance of the Bill passing, it would be by simultaneous petitioning and pressing the subject upon the attention of their representatives.

Mr. **Vallentine** (London Mechanics' Institution) expressed his dissatisfaction at the Bill prepared by the Society; and he thought they had not entered upon the thing so warmly as its importance deserved. He did not think there was any chance of the Bill passing; and he believed that striking out the word "exclusively" rendered the Bill more objectionable than it was before, inasmuch as it would apply to every place of amusement or recreation where there happened to be lectures or a library. He feared that would lead to its rejection.

Mr. **Chester** thought the principle of exemption altogether objectionable; but he begged to state that he had nothing whatever to do with the preparation of the bill. He thought it, at the same time, due to the Council to say that they had done everything to the best of their judgment that was calculated to promote the object in view; but whenever the Council had asked for the support of particular members of parliament to the bill, the reply they received was that they were opposed to the whole thing. So long, however, as the principle of exemption was recognised, he thought it ought to apply to all alike. The Society of Arts had acted with perfect good faith, and in accordance with the advice they received from members of parliament whom they considered competent to give it.

The **Chairman** said the committee appointed to act in this matter, in conjunction with the Society, had met, and gone into the subject most thoroughly. The Bill had been carried out *bona fide*, and in all good faith. If the Society had objected to the bill on principle, they would not have hesitated to say they would have nothing to do with it.

Mr. **Blake** stated he had received a letter from Mr. Hutt, stating that it was not intended to alter the bill. In the committee upon the bill, which sat on the 4th of June, the Lord Advocate proposed the insertion of a clause extending the operation of the bill to Scotland. The bill had been printed, and Mr. Hutt had stated that it was not intended to make any further amendments.

The **Chairman** remarked that Lord Campbell would probably give the bill the most determined opposition in the House of Lords; so that it behoved the delegates to bestir themselves.

The **Lord Mayor** of **York** thought, if that were the case, there was little chance of success in the Lords. The Act of Parliament they had at present was a species of mockery. It proposed to relieve the Institutions from rating, but a word was put in which rendered it ineffective for that purpose.

The conversation then dropped.

Mr. **Chester** said it had been his intention to bring forward a subject which stood upon the paper, as "Suggestions for connecting Institutions with Elementary Examinations, by the Distribution of Prizes and the appointment of Honorary Associates;" but, at the late hour to which the Conference had extended, he would not do so on the present occasion, but hoped to introduce it at the meeting of 1857.

Mr. **Gore** moved the following resolution:—

"That the thanks of this Conference are eminently due to the Council of the Society of Arts for their exertions in developing a system of examinations for the members of Mechanics' and other Institutions; and this Conference is of opinion that such examinations are highly conducive to the advancement of education; and that the Council be requested to publish, as early as possible, the list of subjects and the extent of examination for 1857."

This was seconded by Mr. D. **Bass** (Greenwich Society), and was carried by acclamation.

The Rev. Mr. **Bowditch** moved a vote of thanks to Dr. Booth for his able conduct in presiding over this Conference, and also for his exertions, both individually and in connection with the Society of Arts, in the promotion of education. They were much indebted to him for the ability and courtesy with which he had presided over the business of this day.

The vote having been carried by acclamation, and duly responded to, the Conference then broke up.

ONE HUNDRED AND SECOND ANNIVERSARY DINNER.

The One Hundred and Second Anniversary Dinner of the Society took place at the Crystal Palace, Sydenham, on Tuesday, the 24th of June. Nearly 400 gentlemen were present on the occasion. The chair was occupied by the Right Honorable Lord Ashburton, F.R.S., who was supported by General Sir Charles Pasley, K.C.B., Colonel Sabine, F.R.S., Mr. Alfred Tennyson, the Venerable Archdeacon Lane Freer, Mr. Harry Chester, Sir Watkin Pell, Dr. Sharpey, F.R.S., Captain Laws, R.N., Rev. Dr. Elder, Mr. A. Anderson, Mr. J. Scott, Rev. Professor Brewer, Professor Goodeve, Mr. J. Glaisher, F.R.S., Rev. A. Bath Power, A.M., Dr. Stenhouse, F.R.S., Mr. G. H. Jay, Mr. C. Brooke, M.A., F.R.S., Rev. W. Elliott, Dr. Bernays, Professor Brasseur, Mr. C. R. Weld, Mr. Charles Hill, the Mayor of Birmingham, Mr. W. Lucy, Dr. Waddilove, Mr. Alderman Spiers, Mr. W. De La Rue, F.R.S., Mr. F. Keats (Sheriff elect), Mr. W. Mackrell, Professor Tennant, &c.

The centre cross-table was occupied by the members of the Council of the Society, including Messrs. P. Graham, S. M. Hubert, J. C. Macdonald, Matthew Marshall, J. J. Mechi (Sheriff elect), W. B. Simpson, T. Winkworth, with the Rev. Dr. Booth, F.R.S., Chairman of Council, as Vice-Chairman.

At the Art table were, among others, Dr. Waagen, Messrs. John Bell, Bicknell, F. S. Cary, J. Coe, J. G. Crace, M. Hanhart, C. Ionides, H. Mogford, J. B. Sedgwick, with Mr. David Roberts, R.A., as Vice-Chairman.

At the Manufactures table were, among others, Messrs. R. Milligan, M.P., C. Bagnall, J. M. Blashfield, J. Bull, R. L. Chance, A. Claudet, F.R.S., B. Edgington, R. T. Fauntleroy, G. N. Hooper, J. R. Lavanchy, J. Vavasseur, V. Wanostrocht, with Mr. H. W. Ripley as Vice-Chairman, Mr. Titus Salt, who was to have occupied this position, having been unable to do so owing to ill health.

At the Commerce table were, among others, Messrs. W. D. Asperne, F. Bennoch, W. Bird, J. E. Carlile, J. W. Gilbart, F.R.S., Professor Leone Levi, Vito Terni, with Mr. J. P. Gassiot, F.R.S., as Vice-Chairman, Mr. G. Moffatt, M.P., having been prevented from attending.

At the Colonial table were, among others, Messrs. Hyde Clarke, A. Henderson, T. L. Henley, J. W. Kaye, J. L. Keeling, G. Osborne, P. L. Simmonds, with Col. Sykes, F.R.S., Chairman of the East India Company, as Vice-Chairman.

At the Institutes table were, among others, the Lord Mayor of York, Rev. W. R. Bowditch, Rev. W. Taylor Jones, Messrs. G. M. Coppard, H. Gore, J. Hitchins, J. Hixon, E. Lane, G. Leeman, F. J. Macaulay, T. Martin, Alderman Snow, J. Spanton, H. Whitfeld, J. Yates, F.R.S., with Mr. W. Ewart, M.P., as Vice-Chairman.

At the Agriculture table were, among others, Messrs. J. Caird, J. Bailey Denton, F. H. Elliott, G. A. Elliott, E. T. Mansell, J. C. Morton, with Mr. C. W. Hoskyns as Vice-Chairman.

At the Mechanics and Engineering table were, among others, Messrs. W. B. Adams, C. E. Amos, T. Aston, C. Atherton, J. Braithwaite, E. Chadwick, C.B., D. K. Clark, Sir Charles Fox, F.R.S., A. C. Hobbs, G. Lowe, F.R.S., J. E. McConnell, H. Maudslay, C. May, F.R.S., John Penn, R. Rawlinson, J. Scott Russell, F.R.S., T. Webster, F.R.S., C. W. Williams, with Mr. Joseph Whitworth as Vice-Chairman.

After dinner, the Venerable Archdeacon Lane Freer having said grace,

The Chairman gave as the first toast—"Our Sovereign Lady the Queen: Long may she live to enjoy the love and devotion of a loyal and grateful people." [Drunk with three times three.]

The Chairman then said, I give you—"The Health of our President, Prince Albert," and were I speaking as a lawyer for a verdict, my plea would be sufficient, my cause would be won; but, speaking as your chairman, I have other duties to perform. I have to be the spokesman of your feelings—I have to give embodiment to the associations which the mention of an honoured name raises up in your breasts. Prince Albert is our leader, in the sense that the Duke of Wellington was the leader of every regiment of his peninsular army. We do not actually find him by our side fighting every day in our ranks, but we constantly feel the impulse of his directing mind, and now, in this hour of need, we find him bringing up succour with timely care from other quarters to our rescue. (Cheers). For we cannot dissemble from ourselves the fact that up are at this moment engaged in a fight as it were against nature; we are attempting to infuse the feeling for art, and the knowledge of science from below; to educate the mechanic above those who have to estimate and judge his productions. And observe how the thing acts. If the customer entering a shop could distinguish between the skilled and unskilled tradesman—between the plumber who had learned the first principles of hydrostatics and hydraulics. and the plumber who had not,—there would soon be no ignorant plumbers; the skilled plumber would anxiously select skilled workmen to carry out his views with judgment and discretion, and the workman, finding knowledge necessary to secure employment, would readily pay a remunerative price for its acquisition. (Hear.) Such would be the natural course of things, but mark what takes place now. The customer knows nothing; the tradesman may succeed, though he know nothing. There are no schools organised to teach him, if he would learn,—the tradesman therefore remains ignorant, and woe betide the workman who pretends to know more than his master. If, therefore, we desire to instruct the community, we must begin at the top, not that the class of customers and employers is the most apt to learn,—far from it. The workman is half instructed already, and his mind, trained in the school of real life, has a more healthy energy than the minds of those who have been trained under the fictitious motives appealed to by the schoolmaster. (Hear.) But in order to induce the tired mechanic to study during his hours of rest, he must have some inducement beyond that of acquiring knowledge for its own sake; he must be paid for it in wages or in consideration, and that inducement he cannot hope for from ignorant employers. Prince Albert has felt this difficulty: a difficulty not within the compass of this Society to remove; and he has brought up succour to us from other quarters. He assigned to science and high art its due place in the hierachy of society; he has encouraged our scientific and artistic institutions, but above all he has adopted that course which among Englishmen is of most avail,—he has attended our public meetings, and has in his own person appealed to us to reform ourselves. (Cheers.) Those appeals at the time produced their effect, and would continue to work upon the public mind, if this Society would in its own interest, and in the interest of the cause it espouses, print and circulate Prince Albert's addresses for our use. (Hear, hear.) Meanwhile the movement of scientific and artistic knowledge among the upper classes is rapidly succeeding. By its success we shall be extricated from our embarrassments, and for its early success our thanks will be due to him who has placed himself at its head. I call upon you, therefore, to hail Prince Albert not only as our President, as our individual leader, but I call on you to hail him as the leader of that general intellectual movement in which we play only a subordinate part. (Applause.)

The Chairman again rose and said—The next toast he had to propose was, "The Health of His Royal Highness the Prince of Wales and the rest of the Royal Family," which having been duly acknowledged,

The Chairman said—Though we are assembled here to-day in this gorgeous building, and feast our eyes upon the most beautiful works of man, you will still, I am sure, agree with me in thinking that we are not assembled solely for pastime and enjoyment. We are serious men, engaged in a serious pursuit, and even now, when resting from our work, we cannot forbear from looking back upon it, to see, not only that that is well done which we have done, but to see also that we have not left undone a part of that which was required to be done. There is no man I apprehend in this assembly who doubts the advantage of those public examinations and prizes which you have instituted. You have said to the adult mechanics of England—Here is the whole range of human knowledge classified and spread out for your view. Choose what you please; we are prepared to test and reward your proficiency, and here is a long list of employers who will accept our certificate as a title of merit. (Cheers). This is what you have said, and said wisely, but are you quite sure that in saying this you have completed your work; have you done all that was requisite to ensure its success? Just consider. The adult mechanic is to choose his subject of study. Is he capable of distinguishing useless from useful knowledge? If he be, then he is gifted with a tact and an insight far superior to that of those who have planned out our military examinations, than that of very many authors of educational works; then has he solved a question which still perplexes our Universities. (Hear, hear.) I dare say some one is at this moment whispering to his neighbour—there is no useless knowledge, and I agree with him in the sense of those who say also, there is no useless matter; Who dares affirm that there is any one useless work of God? Is there any one particle of dust beneath our feet which may not at some time be converted, by human ingenuity, to the use of man? And so it is with knowledge. But remember what we are about; we are fitting out a man for the struggles of life; we are not fitting up a storehouse for the use of a philosopher. Man goes forth into the world as a soldier goes forth into a campaign. His wants are boundless, his means of carriage are small. Can any service be greater than that of planning out and assorting his pack of knowledge, rejecting all that shall cumber his movements, selecting all that may afford materials for the business he has to do? (Hear, hear.) Surely there is no more urgent task for us to perform than that we should employ our wisest heads to consider man's powers, to consider man's necessities, to consider man's position in relation to his Maker, his duty to God, to himself, and to his neighbour, and then decide upon what principle that small pack of knowledge shall be composed which he can advantageously bear with him into life. (Cheers.) This is the question of questions; a question affecting the instruction of our teachers, the composition of our schoolbooks, the examinations of our public services; a question the solution of which demands at once the highest qualification of the priest and of the philosopher, and we leave this question to be decided by the yet unlettered, unexperienced mechanic. No wonder that he is listless and hesitating in the pursuit of knowledge, when he is turned out like a child on the sea-beach to fill his lap with whatever may dazzle his eyes or captivate his fancy. No wonder that he soon tires, whatever may be the ardour with which he set out; no wonder that we make of no avail that sacred fervour for higher things, nobler interests, which God has at this moment vouchsafed in his mercy to inspire into our people. (Cheers.) You must, many of you, remember the year 1825, when a similar spirit pervaded the whole land; a cry went forth for a better cultivation. Men revolted at the mechanical toil in which they wasted their lives, forgetful that there is nothing degrading in mechanical pursuits save the mechanical spirit in which it is pursued. (Cheers.) The voice was heard, their complaint was appreciated; the rich came forth with their money, the learned with their counsel. Dr. Birkbeck and other ardent friends of humanity headed the movement; stately buildings were raised; lectures instituted; our hopes were as high then as they are now; and what is the issue; why at the very moment at which I speak there is scarce a Mechanics' Institute which can stand without foreign support, which can pay competent teachers, which could maintain its numbers without constant canvassings and revivals; the fact is that the majority of these Institutions, from the very beginning, had no real life, no inherent powers of motion within themselves; they were born dead. They were galvanised into momentary exertion by the active benevolence of individual founders and managers, but as soon as the external impulse ceased, the whole stopped or assumed a new form, impregnated by a vital principle of an altogether different nature from that originally contemplated. It was then that Mechanics' Institutions degenerated into reading-rooms for the middle classes, where their wives and daughters collected to hear lectures on the drama or music, or any popular topic of the day. And yet the want among the mechanics, which these Institutions sought to satisfy, was undoubted. That want, that craving, continues unabated in their breasts to the present day; if anything, it has grown and grown, in the midst of disappointed hopes and wasted expenditure.—Whence, then, this failure of support; whence this lack on their parts of all operative faith in our promises, of all remunerative demand for that which we propose to supply? It was because, from a want of funds, from a want of competent teachers, of proper school-books, of necessary models and diagrams, recourse was had to a desultory mode of teaching through casual or amateur lecturers. The character of such teaching could scarcely be favourable. Men learned to talk and write, rather than to reflect and act; a few only could derive that solid instruction, the fruit of systematic study, which strengthens and elevates the character: so it became possible that, among the most noted students there might be one who was at times less thrifty in his household, less steady in his conduct, than the jealous scrutiny of his plodding comrades would sanction; and it may, therefore, have happened that over-anxious wives and fathers have come almost to consider the Institute as a kind of intellectual gin-shop, disqualifying its frequenters for the plain duties of life. (Hear, hear.) Knowledge came thus to lose its due consideration, and the mass fell off one by one, to relapse into the more congenial condition of repose. It was because no means had been taken to call forth the spirit of competition to assist with its inspiring influence the love of knowledge for its own sake. It was because we attempted to induce men to toil for that which there was no demand, of which there was no recognition on the part of their employers or customers. Lastly, it was because we did then what we have done now; we introduced an ardent mind into a wilderness of knowledge, without a guide, without even a clue. Such were our wants in 1825, and how do we stand now? An efficient remunerative demand for skilled labour has not as yet been satisfactorily established; the coach-maker, the ironmonger, the mechanic, the artist, inform themselves rather more from a sense of duty than from any reward they can realise from an undiscerning public; but the ignorance of past times is fast clearing away. The class of employers and customers is no longer satisfied with an education for their children based upon the practices of past ages; we are all gradually rising to the platform of knowledge worthy of the second half of the nineteenth century; competent teachers are in a course of rapid training; educational machinery is furnished by the government at a lower cost than even in France. You have evoked the spirit of competition, and you have done your best to obtain rewards for distinguished merit. There remains but one deficiency uncared for—unthought of—and that is the solution of the problem: What is the pack of knowledge with which a man should set forth on the campaign of life? The soldier does not carry with him in his kit the clubs and foils by which his limbs have been trained—he leaves them behind him at the depôt. The man soon forgets the dead languages and pure science by which his faculties were sharpened—he leaves them behind him at school. The soldier bears, in addition to his kit, the special arms of his service—the sword, the lance, or the rifle; so does the grown man add to the knowledge which it behoves him to possess as a man—the knowledge of the plumber, the mason, or the smith. There is no more need to specify what a profession requires, than to speculate for the baker what bread he shall bake. But after you have set aside the knowledge merely used for training the faculties, which is left behind after it has done its work, like the club of the recruit; after you have set aside the special professional knowledge which varies with the individual, which is dictated by the external demand of his special service, there still remains that pack of knowledge common to every man, to every service, which he must bear with him into life as the soldier bears his kit into the campaign, for the satisfaction of necessities. (Hear.) Man goes forth to deal with his brother man in society, to deal with the material world and the powers of nature; he has to preserve his own frame, to improve his faculties, to control his habits and affections. Above all, he has to discover the limited character of his own powers, and the necessary subordination of his petty exertions to the immutable laws of his Maker. Now there is no external demand for this knowledge; the demand must spring up in each man's breast according to the measure of his enlightenment. Can we expect that enlightenment in the young, in the inexperienced, in the illiterate. Is it not our duty to do something more than present the whole range of knowledge mapped out to their view and bid them choose? Is it not our duty to devote at once our utmost efforts to the solution of the question, What is the pack of knowledge which each man should carry with him into the world? His wants are boundless; his means of carriage are small; life is short; school-time is shorter; knowledge is infinite—what shall his pack of knowledge be? I stop here, because the answer to this question involves matters too deep, too serious, for such an occasion as this. I stop here, because I have not the qualifications which befit an instructor of mankind. My part is rather to take post beside the beacon, in the faith that my eager care may so sharpen my perceptions as to descry betimes the rising evil, and call out to the rescue the good, the energetic, and the wise. I see them here before me. My work is done. Your work begins. The Noble Lord concluded by giving "Prosperity to the Society for the Encouragement of Arts, Manufactures, and Commerce," coupled with the name of the Rev. Dr. Booth, Chairman of the Council. (Great applause.)

The Rev. Dr. Booth, F.R.S., said—My lord and gentlemen, it becomes my duty, I believe, as Chairman of the Council, to return thanks for the Society of Arts and its Executive Council. I should not otherwise have ventured to present myself to your notice. Although in our One Hundred and Second Year, our strength was never so great, our health so vigorous, or our finanical position so prosperous. (Hear.) When, twelve months ago, the management of the affairs of the Society was placed in the hands of the present Council, we determined to discharge our trust with all the faithfulness and with all the energy we could command. The great event of this Session is the institution of a system of examinations for the benefit of those persons who attend classes at Mechanics' and other Institutions. In establishing examinations of this kind, we are, in fact, doing nothing more than developing, in the products of the intellect, that principle of competition which was inaugurated with so much success and with such a world-wide renown in the Great Exhibition of 1851. Our first examinations, extending over a period of four days, have been brought to a close, and I am happy to say they have been a real success. Not a few, but several, of the examiners state, that they have been astonished and delighted with the papers they have received. The examiners in chemistry, Professor Solly and Dr. Stenhouse, have so reported. Professor Solly says, "During the last dozen years, in the course of which I have examined many hundred students in chemistry, military, medical, and general classes, I never saw a better or more creditable set of replies. In this Dr. Stenhouse quite agrees with me; we were both equally struck with the general high standard of chemical knowledge shown by the candidates." In mathematics, Mr. Glaisher says the same. The answering in French and German was something remarkable, while in English history and English literature, the examiners were entirely unprepared for the amount of knowledge poured in upon them. In thus encouraging the pursuit of knowledge under difficulties, we are engaged in the most important task that could employ the energies of our Society. We have many qualifications for the office, not the least of which is that we belong to no sect, and we acknowledge no party. Now, who are these men who have displayed such brilliancy of talent, when the outer crust of the obscurity in which they lay concealed has been removed? Why, shopkeepers' boys, schoolmasters' assistants, merchants' clerks, carpenters' apprentices—men engaged from morning till evening in the daily discharge of those duties on which depended their daily bread. (Cheers.) Now, my lord, I say, without hesitation or fear of contradiction, that the Society of Arts has deserved well at the hands of the country, in drawing up to the light of day, from the "dark, unfathomed caves" of their obscurity, such men as these. Again, my lord and gentlemen, I thank you in my own name and that of the Council.

Mr. Harry Chester then rose and said—Engaged as he was every morning with those who were officially occupied in the promotion of public education, he could not help thinking that upon this evening he had fallen into some magnified and multiplied Society of his colleagues, or of a Society for the Promotion of the Education of the People of this Country. It was, perhaps, unnecessary for him to call attention to the fact that they were a Society having more general objects. Although those objects could only be well promoted by improving and extending education, their objects were no less than the Encouragement of Arts, Manufactures, and Commerce; and he thought this was a most encouraging sign of these times, that in a Society having for its object the promotion of Arts, Manufactures, and Commerce, the subject which principally occupied their attention—which seemed to strike directly at all their feelings—was the education of the humbler classes of this nation. (Cheers.) He had been called upon by the Chairman to propose to them to drink "Prosperity to the Institutions in Union with the Society of Arts"—(cheers)—and having a somewhat parental right to propose that toast—having been the person to whom, by a happy accident, it fell originally to propose that the Mechanics' and Literary Institutions of the country should be united with this Society, he felt proud and happy to discharge that duty. He felt also, that, having been honoured with the office of Vice-President of the Society of Arts, he might with some propriety propose this toast, because it was impossible for the Society not to feel a deep interest in the welfare of the Institutions which were united with it. The Institutions now in union with the Society were no fewer than 340 in number—(hear, hear)—he believed he might say that they numbered at least 100,000 members; and he thought it was a small calculation which would tell them that the libraries of these Institutions contained at least two millions of volumes of books. (Hear, hear.) He hoped they would never become a Society having objects more contracted than these, or that those objects would ever be less appreciated than they were at the present time. He hoped this Society, although it had long contained upon its rolls the names of men of high honour in the annals of science, would never become a mere Scientific Association. They could never hope to successfully compete, for example, with the Royal Society, in promoting science in general; but whilst other bodies were aiming at promotion of specific branches of science, he trusted this Society would keep its objects wide and diffuse, embracing the applications of science and all that concerned Arts, Manufactures, and Commerce: that it should be—as Lord Granville happily expressed himself on a former occasion of anniversary celebration—a Society for the promotion of everything that was generally useful or good. (Loud cheers.) He was sorry that on this occasion they had not so many of the representatives of the Institutions in Union present as they had had in former years. That he believed had arisen from an accident beyond their own control. The Conference was held the day before, and it did not suit the convenience of the Directors of the Crystal Palace to let them dine in the building on the day of the Conference. He was sorry that the members who attended the Conference the day before were not present in the same numbers as usual. The Chairman of this assembly and the Chairman of the Council of the Society had both spoken upon the interesting subject of the examinations which had been recently so satisfactorily conducted. Those examinations, no doubt, had been a great success. He doubted whether anything more important for the promotion of education had been done in the last few years. But let them not conceal from themselves that, although in one respect the examinations had been a great success, on the other hand they had been a great failure: that is to say, they had been too much limited; they had not been generally available for Institutions in distant parts of the country, unless they were possessed of sufficient pecuniary resources to pay the expenses of members coming up to London for examination. He trusted that during the current year the Council would be able to enlarge their plans—that, without giving up anything they had done this year, they might do something more next year, and send their examination papers within the reach of every Institution in the country. (Hear, hear.) He thought they had reason to congratulate themselves upon the improved condition of the Institutions, comparing it with what it was when the Union was first formed. He thought they were improved in every respect; that their financial resources were better, that their objects were more vigorously carried out: they aimed at greater and more serious things without giving up the provision of amusements and recreations for the people amongst whom they were placed; and he believed that the introduction of examinations was calculated to convert these Institutions into what all most interested in them had desired them to be—really useful places of systematic instruction. (Hear, hear.) Since the Union had taken place it had been proved that "union is strength" both to the Society of Arts and to the Institutions themselves. They had been recognised by the legislature of the country: an Act of Parliament had been passed, giving extraordinary advantages to the Institutions—such advantages as were enjoyed by no other bodies. The government had extended its grants to these Institutions, and he believed they had retrograded in nothing. He would couple with the toast he had to propose the name of a gentleman who had long been a friend to the Institutions and a friend to education—the name of Mr. Ewart, M.P. (Loud cheers.) In Mr. Ewart the members of these Institutions had always a friend: whenever their interests were brought before Parliament, no one was more ready to promote them than Mr. Ewart. He had the honour to propose "Prosperity to the Institutions in Union," and to couple with the toast the name of Mr. Ewart, one of the Vice-Presidents of the Society of Arts. (The toast was drunk with loud cheering.)

Mr. Ewart, M.P., rose, and said they could all remember the time when these Institutions—the Union of which they were met to celebrate—these Institutions founded originally by the happy genius of Dr. Birkbeck, and very much promoted by Lord Brougham and other friends of education, in what they might now consider distant times; they could remember when these Institutions were in a state of declension. He had watched their early adolescence; he had witnessed the decline of many, and the fall of some of them. He had long been a member of the London Mechanics' Institution. He knew not whether any members of that body were present. It was the first Institution of the kind that was founded in this country, but he was sorry to say it had now arrived at that period of its old age when he lamented to anticipate a very strong appearance of decrepitude. They found these Institutions in a state of decadence. What circumstance was it that first recalled them into existence—that resuscitated and revived them? It was simply the magic principle of Union. (Hear, hear.) In Yorkshire, in some parts of Lancashire, and in other parts of the country, the happy idea suggested itself, that it was not easy for those Societies to exist unless they were united. The Union of these Societies first laid the promise of their re-existence and revival. Many circumstances tended to favour this Union of the different Societies—there was the increased facility of transit—there was the enlarged means of communication with the Continent, which opened new sources of information—and, finally, there was the facility afforded by the educational departments of the Government. All these things united, pointed out not only the advantages, but the facility, of Union. Lastly, there came this Society itself, which, in a moment of happy inspiration, opened to the distant Societies of the country, those facilities which could not possibly be enjoyed by those Institutions so long as they were divided. These were circumstances of happy augury, which were seized upon by the Society of Arts and converted to the best account. He had the happiness of accompanying several gentlemen, officially connected with the Society, as a deputation to Lord Granville, not long since, when his lordship gave his consent on the part of Government to afford the same facilities to these Institutions as those which were afforded to the schools connected with the education of the country,—he meant the advantage of obtaining cheap books and those other facilities, without which, all those Institutions, it was to be feared, would fail in their objects, because, although they had within them the spirit of learning, they had not the power to teach. He could have wished that the Government of the country—attentive to the people in matters of art, literature, and science, had taken advantage of the facilities of communication throughout the land, for the distribution in all our large towns of casts of the best of the works of art which antiquity had handed down to them, and without the help of which they could never attain a knowledge of or a correct taste for works of art. They had also, in the Society of Arts, a happy means of taking advantage of the benefits of Union — and that was, by the distribution of diagrams and the other familiar modes of imparting knowledge, which the present times afforded to them. Lastly, the Society of Arts, as the noble Chairman and Mr. Chester had reminded them, had established a system of examinations. At the same time, he was one of those who thought that examinations might be carried too far. He thought over examination in our universities one of the causes why those universities had not attained the eminence which in former years attached to them; for over examination led to that which, in the familiar language of the universities, was designated "cramming." (Hear, hear, and laughter.) If the object be not knowledge for the love of knowledge; if it be for the sake merely of distinction, or some object of emulation, knowledge was degraded; and the man who sought knowledge for itself was worth twice the value of the man who sought it for the sake of some sudden ambition. While, therefore, he warmly approved, on general principles, of a sound system of examination, he was in favour of evoking the genius of the people of this country by affording all possible means of instruction, and he believed although they might not have such eminent professors of knowledge, they would have more original thinkers, more men of genius, more men who, though they could not repeat a whole book, would have imbibed the spirit of a book. So far, he believed, a system of examination had somewhat tended to lower this country in comparison with other countries. He, therefore, thought the more assistance they gave the people, by which they could educate themselves, the more they would call forth the natural genius of the people, the more they would bring out their genuine taste for literature, science, and art; and although he agreed that those who chose should be examined, yet he thought those who educated themselves were the most genuine productions of nature, and would, in his opinion, in the present day, as they did in former times, shed the greatest glory and the greatest honour on their country. (Cheers.) But whatever might be the opinions which he thus incidentally uttered, in one point he knew they would all coincide, that was, that there was one means by which these Institutions could be maintained—could exist—could flourish—and that was by Union. (Hear, hear.) He had the honour of representing two Societies on that occasion—one in Scotland and one in England, both of them connected with agricultural districts, and he was sure if there was one means more calculated than another to infuse life and vigour into these Institutions, it was their union with this great central Society. Hence they would receive their impulse—hence their future and continued existence. It was, therefore, with the greater pleasure that on this occasion, thanking them for the patience with which they had listened to the few hurried remarks he had made, he avowed the most intimate conviction of his mind that there was one secret source of power in these Institutions, without which they could not continue to exist, and that source of power was Union! (Loud applause.)

Mr. J. P. Gassiott, F.R.S., said since he had entered the room the toast had been placed in his hands of "The development of the natural resources of the dependencies of Great Britain." (Cheers.) What a small part of this great system was the little island on which they lived. When they talked of the resources of their dependencies, he for one felt that they had been a little wanting in their duty to their children, in not bringing them forward fairly. He knew that he was addressing gentlemen of birth, station, and talent, and must, therefore, avoid any approach towards politics; but when he considered their colonial dependencies he could not help thinking, as a merchant of London, that the government had tried an experiment with the most eminent success, in placing at the head of our colony of Jamaica an English merchant, who was, however, about to be transferred to our colony of Australia. Under such a plan they need not fear but that the resources of our dependencies would be developed with the greatest vigour. But there was another dependency—our vast Indian Empire—(hear, hear)—150,000,000 of people looking forward for that support from this country which they had ever received. He should be followed by the hon. and gallant gentleman who occupied the distinguished post of Chairman of the East India Company, and therefore he would be wanting in his duty to this assembly, and to himself, if he detained them any longer in introducing this toast to their notice. He begged to give them—"The development of the natural resources of the dependencies of Great Britain," leaving it for his gallant friend, Colonel Sykes, to respond to the toast. (Cheers.)

Col. Sykes, F.R.S., said, he, like his hon. friend who had just sat down, since he had come into that room had been told that he was expected to reply to a toast, which he much deplored, not only on his own account, but also upon theirs. The toast was nothing more nor less than—"The development of the natural resources of the dependencies of Great Britain." Where on earth were they to come to an end of them? If they went round the world, they found them as they proceeded, until they came back again. Therefore a very serious labour was imposed upon him, if they expected him to be a walking encyclopædia. But he was not; and, therefore, to talk of the development of the resources of he did not know how many colonies—he did not know all their names!—he would tell them plainly he could not do it. But they had a right to expect that he should say something about one great dependency. (Hear, hear.) He would tell them that had been developed, and developed with a vengeance—("Hear," and laughter)—for, from one little factory, commenced in mere commercial speculation on the bank of the Ganges, and from another little factory at Surat, had been developed an empire of 150,000,000 of people, a revenue of £30,000,000 per annum, an army of 300,000 men in the highest state of discipline, and an empire which Alexander the Great and Augustus Cæsar might well have envied. (Cheers.) That was development. But if they talked of development, there were other things besides the development of the material resources: there was also mental development, as well as moral development. They had heard a good deal about mental development, without which there would be no material development. It was the precursor; the one followed the other as a natural sequence and consequence. With regard to the development of the material resources of India, two words would suffice for it. The exports from India had increased in the last 19 years from the value of £9,000,000 sterling to £20,000,000 sterling; and while the exports had increased to that amount, the products of India were of such value, and were in such demand from all parts of the world, that they, the people of Great Britain, could not pay for them with the products of their own industry—of their own skill—and of their own labour, so that they were obliged to have recourse to bullion to settle their accounts. Bullion was a commodity, but it was not to be handled like other things. They could not produce it like articles of cotton, or woollen, or hardware; it was got with difficulty, and taken great care of when got. That being the case, he thought it well for those who heard him to consider seriously whether it was not worth while for the manufacturers of this country to adapt their tastes and the products of their looms and factories to the tastes and wants of the people of India? (Hear, hear.) And he would tell them how that could be done. The people of India had their habits—their indelible habits. They wanted but little, but it must be of a certain character. He would tell the manufacturers around him that if they sent out to India turbans of a certain length and width, with a gold border at the end, they would be bought up by 150,000,000 of people. The women of India wore but one description of cloth. If the manufacturers chose to produce that particular fabric, they would have customers for the same in half the 150,000,000, assuming the proportion of males and females to be about equal in India. The same might be said with regard to other descriptions of clothing. He would tell them what the Americans had done. An American ship reached the coast on the right bank of the Indus; the master of the vessel, having landed there, and bought specimens of every article of clothing that he could procure from the natives — articles as they were worn,—he took them to America, and during the last year they had produced those articles in the exact form and fabric which suited the tastes and wants of the people of India, at a cheaper rate than they were selling in the native markets. What was to prevent the manufacturers of this country doing the same thing? (Hear, hear.) As to the mental resources of India, he was happy to say the people were progressing in the most remarkable manner in some of the higher branches of science. It was true the natives of India did not discuss questions of metaphysics, but they were beginning to be taught the useful arts, and he had just received a beautiful specimen of photography from Bombay, the work of a native. He might mention also, as a curious fact, with regard to mental development in India, that in the administration of justice—he dare say there were not ten persons present who were aware of the fact—that 99 courts out of every 100 were conducted by native judges, well and honestly, and with fewer appeals than was the case with regard to their European superiors. (Hear, hear.) Now, although he could say nothing with regard to the ninety-and-nine other dependencies of this empire, yet they might judge of what they were doing by the fact demonstrated during the last year in the returns of the Custom-house, that in time of war—in time of distress—they found the Custom-house returns were larger than they were the year before. These were proofs of the development of the resources of our dependencies throughout the world. Commerce had flourished in spite of the horrors of war. (Hear, hear.) There was another proof of the well-being and development of the resources of our dependencies. Most of them knew what the excise duties were, but he apprehended very few of them had ascertained what it had cost the people of this country owing to the increased price of bread during the last two years. The people had paid £32,000,000 sterling more than in the former period. What was the result? The excise duties were larger last year than they were the year before—such were the extraordinary national resources of this amazing country and this singularly industrious and rich people. (Hear, hear.) If he said no more he could say this honestly—he acknowledged with great gratitude the honour which had been done him in connecting his name with this toast on the present occasion. (Loud cheering.)

The **Chairman** then rose, and said he had the satisfaction of proposing the toast of "The Learned Societies," coupling with it the name of Colonel Sabine. (Loud applause.) He would only remark that these learned societies were brother sufferers from the same cause—the ignorance, the general ignorance, of the people. It seemed to him a reproach upon the people of this country, that the discovery of a new era in science or art produced less effect upon the public mind than a flourishing speech in a public assembly. They were in the habit of doing their business more by talking than any other nation; but, unfortunately, they could not understand the merits of those scientific men who were laying up imperishable glory for themselves in the annals of the human race. He believed the name of Faraday would scarcely be received with deference if it did not come invested with honour from abroad; in short, it was from abroad that they derived the honour of his name rather than what they knew of him themselves; but better days were coming. They had heard that day a gentleman who was going to reform our public servants—our ambassadors—our governors—our diplomatists—our soldiers—in short, the education of the country. He hoped, at the same time, the hon. gentleman would induce his own friends to educate themselves also—(hear, hear, and laughter), for they all needed education. He (the Chairman) was in Manchester a few days ago, and went over a public building there. He found the iron columns which supported the building were constructed in that form which was least adapted to sustain pressure; and yet the architect who designed that building was a man in high repute, and had been specially selected for that office. He, therefore, trusted the architects would educate themselves. He trusted also, the lawyers generally throughout England, would educate themselves. He hoped that they should find that the lawyer knew something of rational law, and not hurry into courts of justice with that bastard law, which was founded on past rules, and past and exploded precedents. (Hear, hear.) And he hoped further, that the trading classes of this country would educate themselves; he hoped that members of Parliament would instruct themselves; for they saw very little of statesmanship—very little of the knowledge of those principles which alone should dictate the government of a great country like this. (Loud applause.)

Col. **Sabine**, F.R.S., said he would, in the first place, on behalf of his colleagues present, return his best thanks for the kind manner in which the toast had been proposed and received. If circumstances permitted him to say more than a few words on the present occasion, he doubted whether he could find a more important theme than the advantages which arose from the establishment of the most intimate connection between the Societies instituted for the promotion of science and those established for the cultivation of the arts; nor did he think he could find a place more fertile in argument in support of that assertion than the magnificent building in which they were assembled, with all its wondrous contents. (Hear, hear.) It would be superfluous to address any arguments to the present company in respect of the importance of the connection between art and science. If any man doubted it, he would recommend him to take a walk through this noble building, and attend to the reflections that sprung up in his mind, which would convey more that any address he could make. In acknowledgment of the toast so kindly given, he begged leave, on behalf of the Learned Societies, to express their sense of the honour that had been conferred upon them; also, to express their sincere and most cordial wishes for the continued prosperity of the Society of Arts; and, further, to express the great gratification he had felt at hearing of its most useful labours, during the last year, from its most respected Chairman of the Council—Dr. Booth. (Cheers.)

Sir **Charles Fox** said, he was afraid that the task which had been confided to him would be fulfilled in a very inadequate manner. He had to propose the health of those gentlemen who had presented to the Society of Arts the valuable papers that had been read during the present session. (Cheers.) It happened most unfortunately that he had not heard one of those papers, but as he was to be followed by Mr. Wren Hoskyns, who knew all about them, that gentleman would be able to tell them all that was necessary in reference to those valuable papers. Therefore, departing from that subject, if they would bear with him for a few moments, he would express the great pleasure he felt in being a member of the Society of Arts, being, as he was, so intimately connected with manufactures, and knowing so well the feelings of the working classes. (Hear, hear.) When they looked around and saw the great power of England, and asked the question whence had we derived that power, they were obliged to come to the conclusion that they had obtained it in a great measure from the machinery that they possessed. If they looked to other nations they would find that the less wealthy possessed the less machinery. The only means of producing wealth, or nearly so, was by the use of the human hand or the machinery which represented that hand—(hear, hear)—and therefore that nation which paid the greatest attention to the improvement and extension of its machinery must take precedence of the world, and he thought he might say that England had taken that precedence. As no one was so likely to bring about improvements in machinery as those persons who, day by day, used the machinery, he looked with pleasure upon these Institutions, because it was the desire of all connected with them to draw out the talents of the working classes. He looked upon every working man as just as valuable a member of society as any man who sat at these tables—(hear, hear)—and further, he looked upon the happiness of the working classes as just as valuable as that of any one around him; and it was his most earnest desire that the employers of labour should not neglect those who, proceeding from the same common stock, had the same feelings—the same desire for, and the same appreciation of, happiness, and the same capacity for enjoyment, as those whom Providence had placed in a higher sphere of life. (Hear, hear.) There must necessarily be various spheres of society. He was himself a workman once—(cheers)—and he had felt so much for the treatment which workmen generally received (and he was sorry to say it was not the treatment they ought to receive)—he had felt so much upon this subject that he made up his mind twenty years ago, when he ceased to be a workman, that no man in his service should ever receive an unkind expression from his lips—(loud cheers)—and they would excuse him when he added no man of his ever had. He wished to say to all who were gathered around him that if they desired to be happy they would consult the happiness of those who were dependent upon them. That man who looked to himself alone, and desired to produce his own happiness as an isolated being, would fail in doing so. That man would be happiest who took care, every day of his life, to look around him in order to produce the greatest amount of happiness to others. (Hear, hear.) He would then find a number of reflecting surfaces around him which would send back to him as to a focus an amount of delight which no one could conceive who had not placed himself in that position. (Loud cheers.) He begged to propose the health of the gentlemen who had read papers at the Society's meetings during the past session, coupling with it the name of Mr. C. Wren Hoskyns. (Drunk with cheers.)

Mr. C. Wren Hoskyns said, before saying a word in answer to the toast which he had the privilege to hear coupled with his own name, he might be permitted to say a word as to the great loss which he and others near him had experienced in not being able to hear many of the valuable expressions which had fallen from the noble Chairman and other gentlemen who had addressed them. He trusted that on a future occasion they would not have to lament the loss of so much valuable matter, which, in his own case he most particularly experienced, inasmuch as it was with the utmost difficulty that he could catch a few of the words of the gentleman who had mentioned his name in connection with the toast now proposed. He need not add with what pleasure it was that he was able to catch the few expressions that had reached him. Agriculture was the subject with which he was peculiarly connected. He had had the honour of reading a paper before the Society on that subject during the late session, and he would bring forward agriculture as a sphere of occupation in which the truths just enunciated by Sir Charles Fox were more steadily impressed upon the mind than, perhaps, in any other sphere of employment. As an employer of labour he could himself testify to the fact as to the focus of happiness a man found in his own breast from the exercise of kind treatment—the employment of the kind word to their workmen; and in no sphere of life was this more exemplified than in the walks of agricultural pursuits. He felt sensible that those remarks were not altogether impertinent to the objects of this Society, because it had had the great advantage of embracing in one union all those topics which had hitherto the effect of separating men instead of cementing them, and perhaps in no more remarkable instance than that of agriculture, of which this Society was one of the first promoters, and of which thousands of acres testified to the activity of this Society long before the various agricultural societies which now exist had any origin or existence. (Hear, hear.) He had a great deal to thank this Society for, in the interest it had always shown towards agriculture; and he was gratified to find that that interest had not been suspended, although the subject had been taken up in greater detail by a society which peculiarly addressed itself to that object. He believed he might say that agriculture, which formed so large a proportion of the art of mankind—although it played but a subordinate part compared with the immense advancement of the other arts during the last century—yet, during the last twenty years, if a comparison were instituted between the progress in the other arts, or in the sciences which controlled the results of any other art, and the progress of science connected with agriculture, he believed that the latter would be found fairly abreast with almost any other science that could be mentioned. He had been lately a witness of the controversies between Liebig and our own great experimentalist, Mr. Lawes. He believed in that controversy would be found matter of the deepest interest with regard to the constituents of the soil, and the crops to be derived from it. It was a remarkable fact that agriculture had received its greatest advancement from a science with which it was formerly supposed to have no connection. To the improvements in chemistry they were indebted for the great advancement which agriculture had already made. (Hear, hear.) He would content himself by thanking them most heartily for the gratifying interest they had shown for those gentlemen who had read the papers before the Society during the last session. He begged to thank them on their behalf, and to express the gratification he felt at the interest which had been taken in the cause of agriculture by this Society. (Loud cheering.)

Mr. J. J. Mechi said he had been entrusted with a toast, which was "The health of the Society's Examiners." (Cheers.) They owed to those gentlemen a deep debt of gratitude. A number of the most learned men of the present day had devoted much valuable time, without any other remuneration than the thanks of the Society, to an examination into the qualifications of those candidates who had entered themselves as competitors for the Society's prizes. The results of their labours had been to develop an amount of talent which redounded to the honour of the country, and it proved that they had a vast amount of hidden treasure, which only required such an Institution and such prizes to develop. (Hear, hear.) The Almighty gave mind—man only gave education; and he believed they had in this country such fields of mental fertility yet untilled that would produce the happiest results upon society at large, if they only gave the right materials to till them with. (Cheers.) To that end they must, in the early stages, give education—and afterwards give opportunity. The scholastic state of the agricultural districts was disgraceful. In the parish in which he resided, with 5,000 acres, and a population of 1,500, the whole amount of education was imparted in a room 11 feet by 17 feet, by an old dame, who received £15 per annum. That was not a single instance, but might be greatly multiplied. But, supposing they gave education in early days, they must bear in mind that there was a great deal to be done in the adult period of life: and much as he admired these Institutions for adult education, unless they gave their workmen fair and reasonable opportunity to devote to these Institutions, they could not be properly followed up,—and he thought in connection with that subject the early closing movement had a most material relation. He would say, give education to the young, and opportunity to the elder branches of society to improve and benefit by these excellent Institutions. (Loud applause.)

Professor Brewer, in returning thanks for the toast, said, he would not detain them with any lengthened remarks. They had been so kind as to drink the health of the Examiners. All he could say was, the examiners had been happy to give their assistance to a Society which had so long devoted itself to the educational improvement of the working classes, and this was one of the most gratifying features of the case, that almost every gentleman who had been applied to had freely come forward to lend his aid on so interesting an occasion. There had also been the most complete harmony between all the parties concerned in the examinations. That was a gratifying fact at this moment, because it showed, whatever theories men might entertain in their study, when they came forward to work in matters of education, they could be thoroughly agreed. (Cheers.) The good sense of Englishmen would always direct them what was right to be done. He would say one word on the character of the late examination. There were 52 candidates, and two only were first rejected. He had the pleasure of being employed in three different sections, and he would add his testimony to that of the Chairman of Council, that the papers of these young men were most remarkable for precision, for accuracy, and for good English, whilst their writing was beyond all praise. (Loud cheers.) These were qualifications highly desirable in those whose education they wished to advance, and he might remark that in other examinations in which he had taken part, those qualifications had been peculiarly defective. He would add that the papers he received, in conjunction with his friend Mr. Temple, of the examinations in history, were of that first-rate kind that the examiners felt themselves justified in giving five or six first-class certificates, and had it been possible they would have been glad to have presented more than one candidate for the premium awarded by the Society for this subject of examination. The same might be said with regard to the examination in English literature, and he was sure he expressed the opinion of all who took part in the examinations, when he said the general proficiency of those who came before them was far beyond the expectation of those by whom the examinations had been conducted. (Loud applause.)

Mr. Thos. Webster, F.R.S., said he had a grateful duty to perform in proposing the health of the noble Chairman. It was unnecessary for him to dilate at any length upon the great services which Lord Ashburton had rendered to the cause which they were assembled to promote. They had heard from Col. Sykes the great developments which had been going on in our dependencies abroad, and he (Mr. Webster) could not but look at the development which had taken place with regard to the Society of Arts as one of the greatest developments the world had ever seen; for it was not many years ago when it was considered by some that the Society was of no use at all; but within the last ten years it had become confessedly one of the most serviceable societies that any country ever saw. It was true, as Mr. Hoskyns had observed, that agriculture was one of the earliest subjects to which it directed its attention; but one of the great merits, if not the greatest merit of the Society of Arts was this—that it directed itself to whatever was most wanted—(hear, hear)—and they had always found in their noble Chairman one ever ready to throw himself into the breach to carry out anything that was most wanted for the good of the people. They had heard of "bastard law." Having himself something to do with the legal profession, he was delighted to hear that expression from the lips of the Chairman; and having regard to his lordship's practical experience, and the energy with which he carried out everything which he took in hand, he (Mr. Webster) hoped he should see his lordship originating and carrying out reforms in that department, in which the practical experience and ability of men of his character would be of the greatest service. (Loud cheering.)

The toast was drunk with three times three.

The Noble Chairman, in acknowledging the toast, said, his name had been mentioned in connection with improvements of the law. He agreed that the time was come when those improvements ought to be carried into effect. They had extricated the Bible from the hands of the priests, and they now possessed it in a language they could all understand. He was also in hopes that they might eventually get the law books out of the hands of the lawyers. (Loud laughter.) But he must be a bold man who would enter upon that task. It was quite as much as he could do to deal with the schoolmasters. It was with the most anxious attention that he had watched the proceedings of this Society. Day by day it had given the promise of greater things, and he saw at this moment, "looming in the distance," no better promise of advancement than that which was derived from the union of these Institutions. (Cheers.) He felt much honoured by having had the privilege of presiding on this occasion, and he should be rejoiced if any poor efforts of his had assisted them in any way. (Much applause.)

The company then separated.

ANNUAL GENERAL MEETING.

Wednesday, June 25, 1856.

The Annual General Meeting for receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held on Wednesday, the 25th inst., at 4 p.m. The Rev. Dr. Booth, F.R.S., Chairman of Council, presided.

The Chairman, in opening the proceedings, said, that by the bye-laws, he was directed to nominate two gentlemen to act as scrutineers of the ballot for the election of officers. He would ask Messrs. Dennis and Coleman to undertake that office.

These gentlemen having consented to act, the Chairman declared the ballot open. He then called upon the Secretary to read the

ANNUAL REPORT.

It becomes the duty of your Council on this, the formal resignation of their trust, into your hands, to render to you a clear and comprehensive account of their management of your affairs, and to give you a narrative of those events which have marked the progress of your Society during their year of office. To be full and unreserved in the statements we lay before you, frank and candid in the explanations we may be called upon to make, free and open in the answers we shall give to the questions asked of us, is especially our duty, because no other opportunity is afforded during the course of the year to the members of the Society at large to criticise or discuss the measures of the Council than this, the Annual General Meeting; and still further on this ground, that the members of the Society generally are always disposed to place almost unlimited confidence in the discretion and energy of their Council. At the opening of this now closing session we were somewhat large in our promises, and sanguine in our anticipations; it is for you to judge whether the actual performance has realised your expectations.

Visit to Paris.

The first event which signalised our year of office was the visit of your Society to Paris, with its associated Institutions, made at the suggestion of our illustrious President, the Prince. It hardly needs that we should recall to your minds the particular features of an occurrence which must have left on the minds of most of us recollections not less pleasing than enduring. It is a wise policy, whether regarded as promoting a national fraternity, or as facilitating individual acquaintance, or cementing personal friendships, thus to encourage the mingling together of large masses of men with all their nationalties about them, and their prejudices fresh upon them. To amalgamate, even for a time, however short, so many human atoms,, who, but for occasions such as these, would never have come into contact, to transform their repulsions into affinities, to enable them to see with their own eyes that Providence "has made of one blood all nations of men," is a work of true wisdom, and one that perhaps as much as any other ensures the stability of peace.

Revision of Bye-laws.

The first special task on which your Council entered was a thorough revision of the Bye-laws of the Society. They were enacted immediately after the close of the Great Exhibition, of which this house was unquestionably the cradle. They were framed on the supposition that it was about to become a permanent institution of the country, and that our Society was to continue in close and friendly connection with it. These expectations, as you all know, have not been realised. The building in Hyde-park ceased to exist, and the bye-laws became obsolete and impracticable. It was impossible to observe rules which had reference to a state of things that was never in being. The changes in the bye-laws touch no principle already established by the Society. They are rather a series of small reforms and practical improvements suggested by experience. One of them is that, instead of three general meetings for different objects, assembling at inconvenient hours, we have now but one stated Annual General Meeting, on the last Wednesday in June.

Common Seal.

As bearing upon this matter, it may be mentioned that we have cancelled the Common Seal of the Society and adopted a new one, better fitted for use. It will be attached to the certificates and diplomas we are about to issue.

Patent Laws.

Among the many important subjects which have engaged the attention of the Council during the past Session, is the present state of the Patent Office, and what it ought to be. One of our Vice-Presidents, Sir Joseph Paxton, in a communication which he addressed to the Council, gave a lucid, comprehensive, and masterly view of the whole question. In consequence of this appeal, the attention of the public, although at the time much pre-occupied with the events and details of the war, was drawn to the matter, and a committee formed, comprising amongst its members some of the very highest authorities in science and manufacturing industry. The British Association for the Advancement of Science has also taken up the subject, and the strong representations of both committees are now before the Lord Chancellor for his consideration. We need not give you the list of them on the present occasion, as they have already been published in the Society's *Journal* of the 1st of last February.

Rating Bill.

We have next to call your attention to the Bill for amending the Act for exempting Literary and Scientific Institutions from local rates, brought into the House of Commons by three of our members, Mr. Hutt, Mr. Ewart, and Lord Stanley. There is no measure which has been more anxiously pressed upon the notice of the Council than this. At successive Conferences, the representatives of the associated Institutions have urged us to take steps to obtain a parliamentary decision of the question. To meet the wishes of the Institutions, the Council have had a Bill prepared by an eminent lawyer, and, although its clauses are very tame indeed, being merely declaratory and not enacting, it has met with the most strenuous opposition in its passage through the House. So strong has been the feeling against it, that Mr. Hutt has been compelled to withdraw the Bill to have it recommitted. We should only deceive the Society, and especially the Institutions in Union, were we to hold out any very confident expectation that a satisfactory Act in the present temper of the Legislature can be obtained. The Council, however, will not relax their exertions to secure, if possible, the passing of the Bill.

Supply of Text-Books.

There is, however, another measure which bears directly on the welfare and usefulness of the Mechanics' Institutions, with respect to which we have achieved a more decided success. We refer to the valuable privilege so liberally and so frankly conceded by the President of the Council to our representations. Under this concession the Institutions associated with the Society of Arts may supply themselves, at little more than half price, with books, maps, models, and other scientific apparatus for educational purposes. And the Council cannot but hope that the same liberal and comprehensive policy will afford at least partial aid to Institutions whose managers may desire to establish class teaching and to provide well qualified teachers to conduct it.

List of Lecturers, &c.

While on this point it is proper to mention that an important Manual—a Directory of Lecturers, has been prepared by our Secretary, for the use of such Institutions as may desire to enter into arrangements with lecturers. To this is added a priced list of Diagrams and apparatus, suited for the use of the lecturer or class teacher. It will be found, we have no doubt, a book of reference of much value to the Secretaries of Literary Societies generally, and will much facilitate their arrangements, as well as give them an ampler choice of selection.

ECONOMIC MUSEUMS.

Mr. Twining, whose philanthropic labours are so well known to the members of this Society, and to the public generally, whose disinterested exertions to promote the domestic comforts of the poor, have received in foreign countries, especially in France, ample acknowledgment and honorary reward, has been engaged, under the sanction of our Society, in advocating the utility and aiding in the establishment of Economic Museums for the use of the working classes. It is indeed to be regretted that the delicate state of Mr. Twining's health has delayed the arrangements and display of the materials he collected. At the International Congress which is to assemble at Brussels in the autumn of this year, the subject of Economic Museums, on Mr. Twining's plan, will form an important feature. The Council beg to draw the attention of the members of the Society, and of manufacturers generally, to the opportunity which will be then afforded for the display of those articles which tend to promote the domestic comfort of the poorer classes.

EVENING MEETINGS.

During the past year our evening meetings have been well attended, and they still continue the important feature in the proceedings of our Society. The Council believe they have been eminently fortunate in securing the services of men who hold the very highest rank as authorities on the subjects about which they have communicated, always interesting and frequently novel as well as valuable information.

The Council found it a matter of much difficulty to decide on the award of the Medals, so many of the papers reached to a high degree of excellence.

The following Medals have been awarded :—

To Mr. J. Kenyon Blackwell, F.G.S., for his paper " On the Iron Industry of Great Britain with Reference to that of other Countries." *The Society's Silver Medal.*

To Mr. Humphrey Chamberlain, for his paper, " On the Manufacture of Bricks by Machinery " and "On the Drying and Burning of Bricks." *The Society's Silver Medal.*

To Mr. John Bailey Denton, for his paper "On the Progress and Results of the Under-Drainage of Land in Great Britain." *The Society's Silver Medal.*

To Mr. William Felkin, for his paper " On the History and Present State of the Machine-Wrought Lace Trade." *The Society's Silver Medal.*

To Mr. Chandos Wren Hoskyns, for his paper "On the Progress of Agriculture During the Past Fifteen Years." *The Society's Silver Medal.*

The papers read by Mr. William Hawes, Mr. G. F. Wilson, F.R.S., and Mr. Winkworth, have not been taken into consideration in the award of the Medals, as Members of the Council are precluded from receiving the rewards of the Society.

USEFUL INVENTIONS.

It is the hereditary policy of the Society, and has long been the practice of the Council, to award its distinctions to the contrivers of useful inventions and to the discoverers of valuable products.

It gives us much pleasure to be enabled on the present occasion to comply with the traditional usage of the Society, and to announce that the following Medals have been awarded :—

To Professor Clark, M.D., of Marischal College and University, Aberdeen, for his " Application of Lime to the Softening and Purifying of Water for the supply of Towns." *The Society's Silver Medal.*

To Herr Paul Pretsch, late Manager of the Imperial Printing Office, Vienna, for his " Application of Photography and the Electrotype to the Production of Engraved Copper-plates for Printing." *The Society's Silver Medal.*

To Mr. James King. for the " Importation of Wine, the Growth of Vineyards in New South Wales." *The Society's Silver Medal.*

With regard to this last reward, it is proper to observe that, in 1845, the Society's Medal was awarded to Messrs. McArthur for the importation of wines from Australia, the Messrs. McArthur having been induced, by the Society's offer of reward, to attempt the cultivation of the vine in New South Wales.

SPECIAL PRIZES.

The Society's Gold Medal—value Twenty-five guineas, has been awarded by the judges appointed by the Council, to Mr. Charles Wye Williams, for his Essay "On the Smoke Nuisance."

The Society's Silver Medal has been awarded to Mr. Charles Hood, F.R.S., for his Essay on the same subject.

UNION OF COLONIAL INSTITUTIONS.

The Council, ever desirous to widen the sphere of the Society's influence, and to enlarge its borders, swayed, too, we are bound to say, by strong representations from abroad, have determined, during the past session, to extend the privileges of union to the scientific and literary societies of the British Colonies. And we are rejoiced to report that within a comparatively short period several Colonial Institutions have become associated with us. Of these may be mentioned the Royal Society of Arts of Jamaica, the Fredericton Athenæum of New Brunswick, and the Agricultural and Horticultural Society of India, Calcutta.

You will find the conditions of Union in No. 161 of the *Journal of the Society of Arts*, being the number for the 21st of December, 1855.*

We cannot refrain from saying that nothing would tend more intimately to unite together Englishmen of every colony and clime into one compacted mass of loving and loyal subjects than the free and full participation in all the privileges and benefits of the laws and institutions of the mother country by our fellow-countrymen abroad. Surely we have had no reason to regret that Nova Scotia was permitted to testify her sympathy with us by sending to our aid Sir William Williams of Kars.

Honorary Local Secretaries.

Moved still further by the same desire to render your Society all-embracing in its influences, the Council have sought the aid of men of high standing and varied attainments to discharge the duties of Honorary Local Secretaries. As the memorandum which was drawn up and presented to the Council some short time ago by a committee of its members, appointed to investigate and report on the subject, was printed in the Society's *Journal** very recently, we need not occupy your time with reading it here. We have as yet made but few appointments to the office, but amongst those we have selected are, Mr. W. Felkin, of Nottingham, Mr. Sands Cox, of Birmingham, Mr. John Waterhouse, of Halifax, Mr. Tartt, of Cheltenham.

Examinations.

I come now to the great movement of the present Session—the institution of a system of periodical examinations. Causes to which it is needless here more particularly to refer, delayed the putting forth of the scheme till a late period of the Session. This delay would have been fatal to its success, had it not contained the principle of life strong within it. But, notwithstanding this and other untoward circumstances, our examinations have been a great success.

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* The conditions are reprinted here for convenience of reference:—

Union of Colonial Scientific Institutions with the Society of Arts.

The Council of the Society of Arts, having received an application from the Jamaica Society of Arts to be taken into Union, on the same footing as the Mechanics' Institutions of Great Britain and Ireland, have had under consideration for some time past the means of most effectually extending the benefits of the principles of association and co-operation to similar Societies throughout the British Colonies and India. With this view they have laid down the following conditions and terms of Union:—

I.—The Society of Arts is prepared to receive into Union any Institution, established in a British Colony, or in the British Possessions in India, for the advancement of Literature and Science, or for the encouragement of Arts, Manufactures, and Commerce.

II.—It shall be the duty of the Officers of the Society of Arts to correspond with the Secretaries of such Associated Colonial Institutions, on matters relating to their recognised objects.

III.—The productions or manufactures of a Colony, transmitted by a Colonial Associated Institution, shall receive all due publicity, by means of the Society's Exhibitions, Publications, and Discussions.

IV.—The weekly *Journal* of the Society, with its other publications, shall be duly forwarded to every Associated Colonial Institution, and a portion of the columns of the *Journal* shall be reserved for Colonial Discussions and Correspondence.

V.—Whenever any member of an Associated Colonial Institution, bearing a letter of introduction from its Secretary, shall visit London, he may enjoy the usual privileges of a Corresponding Member of the Society of Arts during his stay, and may have his letters addressed to him at the Society's House in the Adelphi.

VI.—The Council will afford their advice and assistance to any Colonial Associated Institution which may desire to obtain in England or France any scientific or educational apparatus, and will obtain and furnish to any Colonial Associated Institution reports on any produce sent over for examination.

VII.—A Colonial Associated Institution shall have the privilege of purchasing books through the Society's agency on the same scale of reduction as is now granted to Home Associated Institutions.

VIII.—The system of examination proposed to be instituted by the Society of Arts shall be extended so as to embrace candidates who shall have duly attended classes at Colonial Associated Institutions, and certificates of merit shall be awarded by the Society's examiners on examination papers duly authenticated and remitted from the Colonies.

IX.—A Colonial Institution may be admitted into Union on the same terms as a Home Institution, namely, an annual payment of two guineas.

(By order,)
PETER LE NEVE FOSTER, M.A., *Secretary*.
Society's House, Adelphi, London,
Dec. 19, 1856.

* Honorary Local Secretaries of the Society of Arts.

The Council have resolved to appoint Honorary Local Secretaries of the Society of Arts in the several provincial cities and large towns of the United Kingdom. The Society of Arts has long felt the need of authentic sources of local information and the want of provincial co-operation.

The approbation with which its measures have been generally received, proves that the sympathies of the country, when elicited and tested, are with it. But sympathy is not enough,—active co-operation is required. There are besides many subjects of national and local importance on which accurate information in abundance exists, but it cannot be turned to general account because not generally known.

To multiply the centres of the Society's operations, and to direct the energies of many who are prepared zealously to aid the Society, if they could but see the way to do so, the Council propose to invite gentlemen of standing and of influence in their respective neighbourhoods to undertake the office of Honorary Local Secretary of the Society of Arts. They will receive the Society's *Journal* and other published documents from time to time; and the facilities of an office for receiving and forwarding letters, books, &c., will be afforded them at the Society's House in the Adelphi. The Honorary Local Secretaries will be expected to advise the Council on such matters as may be submitted to them, and to afford generally their aid in promoting the objects of the Society. They will go out of office annually, with the Council and Officers, but may be re-appointed after the annual election of the Council of the Society. Their names will be published with those of the President, the Vice-Presidents, the Council, and the Officers of the Society.—*Journal of the Society of Arts*, May 23, 1856.

It may be said, what has a Society, whose province is the encouragement of Art, Manufactures, and Commerce, to do with examinations? Now, in first place, the time has long gone by since our Society could render any effectual aid to do that which had much better be left to the influence of the laws of supply and demand, and to the individual enterprise of our merchants and manufacturers. While protection was the established principle of commercial intercourse, the encouragement of manufactures and commerce was a phrase of clear and definite meaning. But manufactures and commerce have long outgrown the confined habiliments of childhood. Though in this sense of direct encouragement, by offering prizes or medals for the importation of new products, or the opening up of out-of-the-way channels of trade, the Society can do but little, yet, in giving full play to the principle of competition, whether material or intellectual, it can accomplish much. Of this power, inherent in the Society, we cannot give a better illustration than the full development of the principle of competition in the multitudinous display of the Great Exhibition of 1851. Here the principle was brought and expanded to an extent never before known. The year of the Great Exhibition in Hyde-park has become a well-defined era in the annals of material development. Men now speak familiarly of such and such a thing as dating its origin or improvement from the year of the Great Exhibition; of some other thing perhaps as being then invented; or of something else as having then been superseded. Now that principle of competition in material things which the Society, under the guidance of its illustrious President, developed with so much energy and so much success, the Council this year have applied to intellectual things, and let no man say that in so doing we forget our duties or step beyond our province. In no other way can we so effectually cherish a taste for art, or promote the improvement of our manufactures, or the spread of our commerce, as by fostering the genius, encouraging the talent, rewarding the industry, and honouring the perseverance of those by whom the moral well-being and the material prosperity of this country may be best secured. The examinations have been eminently successful so far. The report of the Board of Examiners to the Council will be found a very interesting and valuable document. Its publication will confirm this assertion, and the Council would ill discharge their duty did they not take this formal and public opportunity to record the high sense which they entertain of the patience, the scrupulous accuracy, and the perfect fairness with which during four tedious days, for nine hours each day, they discharged the irksome and laborious duties they had undertaken. The Society has been most fortunate in obtaining the unbought aid of men of such eminence in their respective departments. Nor must the demeanour of the candidates be passed over in silence. Their steady application and painstaking industry were observed by all, and witnessed by many with surprise. The Report of the Examiners, embracing fully the whole of the details of the Examinations, will be immediately published and circulated. The arrangements for holding the Examinations next year are now under consideration, and the entire programme of the examinations for 1857, with the Lists of Subjects and Prizes, will be made fully known with the least possible delay. If a part only of the employers of labour, whether manual or intellectual, who have signed the declaration of confidence in the Society, will take into their employment those young men whom we can strongly recommend, on the grounds of their industry and attainments—we do not, nor could we if we would, investigate moral character—if a tithe only of those who have signed our declaration will give employment to those who shall have passed our examinations with credit, more will have been done to promote education—more encouragement will have been given to the formation of habits of self-culture and private study, than if thousands upon thousands of the public money had been expended on the establishment of schools, and the payment of schoolmasters to occupy them. The reason is manifest—you need not got far to look for it. The moment you make tested intelligence and tried capacity, and ascertained acquirements, the only sure passports to lucrative employment and honourable position, that instant, as by the wand of an enchanter, you will have changed at once the entire aspect of the educational question in this country. It will assume a new phase. Whenever you make this the general rule, and not the occasional exception, you at the same time make every man his own schoolmaster. Learning ceases to be a luxury; it becomes a necessary of life. A boy's books become literally his bread, and he must, in short, either study or starve.

The Council have only in conclusion to add, that the financial position of the Society of Arts is one of unexampled prosperity. This is still more remarkable when we take into account that last session was in the second year of the war. Our receipts last year, from every source, were nearly £5,000. We spent upwards of £1,000 less than our income, and discharged about £1,200 of antecedent liabilities. The Royal Commissioners of the Great Exhibition have purchased the Society's interest in the Trade

Museum, collected and arranged by Professor Solly. In resigning their charge of this valuable collection of animal products to the Commissioners, the Council of the Society of Arts stipulated that it should be exhibited on favourable conditions to the public. The correspondence between the Royal Commissioners and the Council of our Society has been published, as well in the third report of the Commissioners, as in the *Journal of the Society of Arts*. The Treasurers of the Society have recommended that of this sum now receivable, £500 be appropriated towards the liquidation of the debenture debt now due by the Society, and we have every reasonable ground to hope that, long before our next annual meeting, the Society will be completely free from this debt, and that we shall have a considerable available balance at the Society's bankers. The debt of which we are speaking is one of £1000, which during the last eight years has pressed upon the finances of the Society. When you consider that this state of financial prosperity has accrued during the last year of a burdensome war, that the Society has entered with all the matured vigour of manhood on the second century of its course; while, during the first, it expended nearly £200,000 in promoting useful objects of every kind; and when we add to this, that, during all that time it neither applied for nor received a single shilling of the public money, very sure are we that the members of the Society for the Encouragement of Arts, Manufactures, and Commerce have ample grounds to congratulate themselves on the present state and future prospects of their Society.

The Secretary then read the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, which was published in the last number of the Journal, page 531.

Mr. T. WEBSTER, F.R.S., said he had great pleasure in moving the adoption of a report so satisfactory on the state of the Society, and he believed that if the Society were carried on with the same energy with which it had been done during the past few years, the anticipations of the Report were not too sanguine as to the importance of the Society as a national institution. He much regretted that such a report should be made to so thin a meeting, and would suggest whether some means could not be taken for ensuring a larger attendance, as by holding it before the annual dinner, or at some other period of the year. It was of the greatest importance to ensure a full attendance to consider and discuss the subjects adverted to in the report, and he hoped the Council would take the matter into their consideration.

Mr. DENNIS had much pleasure in seconding the resolution.

Mr. HARRY CHESTER agreed with Mr. Webster that it was much to be regretted that a Report so satisfactory, and full of matter of such great and far-reaching interest, should have been received by so thin a meeting. The Chairman's address, at the opening of a Session, when he announced what the Council intended to do in that Session, was always listened to by an overcrowded audience; but the annual report of the Council, which described what had actually been done, was always presented to an almost empty room. It was strange that the members of the Society should always be so anxious to know what was going to be done, and so very indifferent afterwards about it. It might be said that the absence of the members implied their confidence in the Council; but the Council wanted the active co-operation of the members, that stamp of hearty approval and interest in their proceedings which attendance at the annual meeting affords, and which is necessary to strengthen the hands of the Council in their high and onerous duties. On the present occasion the Report was a most valuable document, and dealt with matters whose importance could scarcely be overrated by any one. Although himself a member of the Council, he had had no hand in the preparation of the Report. Illness and other causes had prevented his attendance at the Council; and he could therefore speak of its proceedings as an impartial member of the Society. He felt the deepest interest in what had been done for the examination of the students of the classes of the Institutes in Union with the Society. It was an admirable beginning of a system which was calculated to do more for the Institutes, more for the interests of national education, and the reform of the service of the crown, and other services, than almost anything that had been elsewhere done. It was not to be denied that competitive examination was a hobby which some persons were riding too hardly. Examination, as Mr. Ewart had said, might be carried too far—that is, too much might be expected of it. Ill-regulated, it might induce "cramming" and other evils. But, after all, it was better that a man should be crammed than starved, especially if, while some were injuriously crammed, others obtained a wholesome stimulus which led them to take a nutriment which they might otherwise want, and not only to take, but digest and assimilate it. At any rate it seemed impossible that competitive examinations could be open to too great a number. If they were good, on the whole, for the student at Oxford or Cambridge, they must be good, on the whole, for the less favoured classes, for the students of the Institutes in Union with us. It was a noble object—a great national object—to bring within the reach of those poor men, a few at least of those encouragements to study, and those rewards of study, which were so abundantly open to the candidates in the competitive examinations for honourable and substantial rewards at Oxford and Cambridge, and other great seats of learning. He hoped that the Council would publish the fullest possible details of the late examinations, and especially that they would publish the examination papers—the questions, and the replies of the successful candidates. At the Conference, objections had been taken to oral examinations. In these objections he did not concur. If the examinations must be either all oral, or all paper, he would prefer the latter, as less liable to accidental failures; but the best system was a mixture of oral and written questioning, which had been adopted on this occasion by the Council of the Society of Arts. Written questioning is the best mode of ascertaining what a man knows—oral questioning is the best mode of ascertaining what he is. The best mode is a combination of the two, and it had been used by the Council with the happiest effect in the hands of a body of examiners of the highest distinction and skill, whose services had been generously given to the Society, and who deserved our warmest acknowledgments. To the Chairman of the Council, Dr. Booth, for his very vigorous and successful efforts in this matter, the Society, and, indeed, all the friends of education, were greatly indebted. While, however, what had been done was undoubtedly a very great success, the Society must not deceive itself with the notion that the wants of the Institutions in Union had been met by the late Central examinations at the Society's House. It was clearly brought out at the Conference, that the Institutions required much more; that the distant and poor Institutions could not afford to send their students to be examined in London; and that they wanted a system of examinations carried to their very doors. The only system that could possibly fulfil that condition, was the system of examination by papers, sent simultaneously to the different places, worked there simultaneously (under proper securities against copying and other unfairness), and thence simultaneously returned to London, to be examined and decided on by a Board of Examiners. Such was the system of the Committee of Council on Education, which Mr. Bath Power had so clearly explained to the Conference. Such was the system which he (Mr. Harry Chester) had proposed in 1854; which the Council had submitted to the Conference in that year; and which the Conference, by a unanimous vote, had adopted. In 1855, however, when that system of examination was proposed to be carried out by the Council, it was not taken up by the Institutes themselves; and necessarily fell to the ground. Then it was that the vigorous mind of the Chairman (Dr. Booth) achieved the plan which had justly been described by the Council as a "great success." The Institutes, however, now desired to revert to the plan of 1854, as meeting their peculiar wants, and the great object now was to combine the two plans. This, he thought, could be effected by making the examinations on the plan of 1854 a preliminary to the examinations on Dr. Booth's plan. The Council appeared to have thought that the examinations in writing, held simultaneously in different districts, though perfectly successful in the hands of the Committee of Privy Council, which had a staff of experienced Inspectors to preside at the examinations in the several districts, might fail in the hands of the Society of Arts, which had no such officers at its command, and therefore no such means of preventing "copying" and other unfairness. It was, of course, absolutely necessary that such precautions should be effectually taken, and he thought that this Society, for an object so very important, might obtain the requisite official assistance. He was not authorised by government to say so—he spoke merely as a member of the Society of Arts—but he could not help thinking that, if applied to by the Society, the Committee of Council on Education would readily lend its 40 inspectors for two days (which would be all that was requisite), in the year, to preside at the local examinations. Then there were the Principals of the forty Training Colleges, whose zeal for education was such that he was sure they would to a man assist the Society with similar services for such an object. Here were eighty presidents of the highest competency; and there were numbers of other men, accustomed to examinations at Oxford and Cambridge, and elsewhere, whose aid would most cheerfully be given. He saw no difficulty in providing fit persons to preside at the examinations in (say) 150 different places. All, in fact, that was necessary was, to secure fairness in working the papers. They would then be returned to London; and doubtless the labour of revising and deciding on them would be very heavy and important. It should be committed to the best judges that could be found; and the Society should remunerate them very liberally for their service. From the papers which they should place in the first class, a limited few of the very best should be selected; and the authors of these should be invited, and assisted (pecuniarily), by the Society to present themselves at our house, and to undergo a higher examination, both oral and written, before our most eminent Board of Examiners; and the most successful in this competition might receive the highest honours that the Society can give, and might be appointed Honorary Associates of the Society of Arts. Such was an outline of what he thought might be done in this important matter. He commended it to the consideration of the Council, and of its Chairman, whose services were so highly appreciated in connexion with the subject of competitive examination.

The **Chairman** then put the motion to the meeting, when the report was unanimously adopted.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following noblemen and gentlemen had been elected to fill the several offices. The names in *italics* are those of members who have not filled the offices to which they have been respectively elected during the past year.

COUNCIL.

PRESIDENT.

H.R.H. Prince Albert, F.R.S., &c., &c.

VICE-PRESIDENTS.

Lord Ashburton, F.R.S.
Harry Chester.
Henry Cole, C.B.
C. Wentworth Dilke.
Viscount Ebrington, M.P.
William Ewart, M.P.
The Earl Granville, F.R.S.
Lord Robert Grosvenor, M.P.
The Earl of Harrowby, F.R.S.
The Dean of Hereford.
William Hutt, M.P.
Marquis of Lansdowne.
George Moffatt, M.P.
Sir Joseph Paxton, M.P.
Dr. Lyon Playfair, C.B., F.R.S.
John Scott Russell, F.R.S.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
William Tooke, F.R.S.
Thomas Twining, Jun.

OTHER MEMBERS OF COUNCIL.

Francis Bennoch.
Rev. Dr. Booth, F.R.S., *Treasurer.*
J. W. Gilbart, F.R.S., Treasurer.
James Glaisher, F.R.S.
Joseph Glynn, F.R.S.
Peter Graham.
John Cameron Macdonald.
Matthew Marshall.
John Joseph Mechi.
Edward Solly, F.R.S.
Dr. Stenhouse, F.R.S.
Colonel Sykes, F.R.S.
George Fergusson Wilson, F.R.S.
Thomas Winkworth.

AUDITORS.

William Mackrell.
W. B. Simpson.

SECRETARY.

Peter Le Neve Foster, M.A.

COLLECTOR AND FINANCIAL OFFICER.

Samuel Thomas Davenport.

Home Correspondence.

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TONNAGE REGISTRATION.

Sir,—The following remarks are appended, in the *Mechanics' Magazine* of this day, to Mr. Atherton's letter, which was published in your number of yesterday. For the reasons mentioned in my last letter to you, I have to request that you will give insertion to them in the next number of your *Journal*.

I am, Sir, your obedient servant,
THE EDITOR OF THE
MECHANICS' MAGAZINE.

166, Fleet-street, London, June 21st, 1856.

"A very few words will suffice by way of reply to Mr. Atherton's letter which we have just inserted. It is a matter of very little importance, as affecting the main question at issue, whether Mr. Atherton has really been driven to occupy a different position, or whether we, in common with the great majority of those who have felt an interest in the question, have hitherto misapprehended his views, and are now for the first time acquiring a tolerable acquaintance with their true import. For this misapprehension, if such it be, Mr. Atherton has no one to blame but himself. In the original essay which has given rise to all this discussion, he attacked with such an amount of vigour what it *now* appears were not vital deficiencies of the present system of registration, but merely matters of inferior moment, and sought to substantiate with such a degree of earnestness what are *now* represented to be the real principles of the essay, and also the several details of the system to be substituted, that it is no wonder that the public in general, not possessing the clue to the labyrinth which Mr. Atherton himself possessed in the inmost recesses of his mind, made a fatal confusion between the *essentials* and *non-essentials* of the new system.

"Mr. Atherton ought to feel himself under deep obligations to us for having furnished him with the opportunity of explaining this important distinction. And, notwithstanding his good-humoured deprecations, we really do congratulate him on the number of points which seemed to us, and to the uninitiated in general, settled in the new system, but which are now consigned to the more uncertain regions of 'consultative deliberation.' However, as we said, it is a matter of little moment whether Mr. Atherton or ourselves appear in the character of converts and recruits. In the same spirit in which he has come forward in his last letter we are willing to meet him.

"With regard to the enormous difference of real carrying capacity which Mr. Atherton tells us may very well exist between two ships of the same nominal registration of 1,000 tons, we think he has done well in restricting his observations to the case of the vessel which he supposes may well afford to carry 3,000 tons of *dead weight* cargo, and in omitting altogether the case of the unfortunate vessel which cannot get beyond its 500 tons.

"The cellular principle of build will doubtless admit of a great difference between the external and internal *displacement* of a vessel; but it is much to be questioned whether the disadvantages of this disproportion are not so much greater than the advantages as to render the internal measurement of the tonnage fair in a fiscal point of view. Merchants are much more anxious to obtain a vessel that will carry a great bulk, with comparatively small weight, than one that will carry a great weight with little bulk; for the greater part of cargoes of goods—especially the more valuable kind—are specifically *lighter*, not *heavier* than water; and internal roomage is, on the whole, in a commercial point of view, more valuable than external displacement. We fully expected that Mr. Atherton would refer to the cellularly-built iron ships as cases in point. But we really believe the great disproportion of the internal to the external measurement of the leviathan ship now building on that principle, will be felt by the owners as a great mischief; they will, of course, wish to carry a mixed average cargo; and to *fill* their hold with a heavy cargo would neither be very practicable nor conducive to their own interests. We believe that to charge them with dues for more than the internal roomage would be unjust.

"On the other hand, be it remembered that the *internal* roomage divided by 100 is the legal tonnage of a vessel; 35 cubic feet of sea-water weigh a ton; consequently, 1,000 tons of dead weight carried aboard a vessel of 1,000 tons registered tonnage, would only cause a displacement of 35,000 cubic feet, whereas the whole *internal* (not external) roomage is 100,000 cubic feet. We are certainly, therefore, well within bounds when we assert that there can be no doubt that every ship of 1,000 tons register may fairly be expected to carry at least 1,000 tons weight of goods.

"We have offered no opinion on the mode in which the allowance is made for the space occupied by the engine and boilers on board steam vessels by the present law, nor on the justice and propriety of making this allowance at all. We believe the owners of sailing vessels generally feel this part of the law as a great grievance; and we are, on the whole, disposed to concur in this opinion, which seems also to have been shared by the Tonnage Commission of 1849.

"The legislature have undoubtedly always looked upon tonnage registration simply from a fiscal point of view; and by removing all temptation to owners to procure vessels to be built of a bad form—as they have certainly done by the new law—they have rendered an essential service to the cause of science which it were ungrateful to deny or overlook, still more to treat as a misdemeanor and a crime.

"Mr. Atherton states that our notions as to his views on the question of external *versus* internal measurement for tonnage have been completely at fault, and he expresses a hope that by his explanation he has now established a concurrence of opinion between us. As we hear no more of his French mode of measurement for fiscal purposes, and of his continued product of two external dimensions and one internal, corrected by an empirical factor, which, together with the whole *detail* of the new system of measurement he proposes, is consigned to the regions of 'consultative deliberation,' this may possibly be the case.

"Of this, however, let him be assured, that we, in common with all the practical men who have spoken out on this question, are satisfied that the levying of dues and tolls on the nominal tonnage, calculated in accordance with the law of 1854, is as fair as can reasonably be expected, and that we will be no parties to any agitation which may have for its object the repeal of the rule as now by law enforced. We are satisfied that, a 'reasonably fair enactment' being now in force, infinite harm will be the result of any serious attempt to unsettle it; and all the advantage which some enthusiasts anticipate from a change would be found futile.

"If, therefore, we consent to follow the guiding of 'Coryphæus, the agitator' (and we by no means wish to decry all agitation as an evil), and give in our adherence to the principle of remitting any questions connected with shipping registration to the action of 'consultative deliberation,' they must be entirely by way of *addition* to—not of *alteration* of—the registration clauses of the Merchant Shipping Act, so far, that is, as sailing ships are concerned. We should have no objection to see—or rather we should say we should see with satisfaction—a competent committee appointed by the government—or by the British Association, or some other scientific society in the first instance, with a view of ultimately, if need be, acting on the government,—to take into consideration the following points:—

"1. Whether, it being conceded that there is a limit beyond which it is dangerous to load ships, it is *possible* to assign that limit for every ship by interference of government, without running unnecessary risk of limiting or cramping the progress of naval architecture, or inflicting commercial injury.

"2. In case this should be answered affirmatively, by what means the determination of such limit may be effected.

"3. Whether, without undue interference with the freedom of action of shipowners and shipbuilders, and the consequent discouragement of improvement in the building of merchant ships, it be *possible* or advisable to acquire the registration of any other elements of construction which may be interesting and beneficial in a scientific point of view.

'Now, if Mr. Atherton will only limit his agitation to the appointment of a committee, and that a competent committee, of gentlemen, not nominated by one or two individuals, but fairly selected, either for their scientific or practical knowledge of the subject—such a committee as must command the respect of the shipping interests—to consider and report upon the points stated above, he will have our cordial concurrence. If, however, he agitates for the unsettling of the fiscal arrangement for levying dues which now, after many years, at last seems settled upon a fair basis, he as assuredly will meet with our opposition.

"We now come to Mr. Peake's rule, in our remarks upon which we must include all that we have to say in reply to both the gentlemen who have addressed us on this part of the question.* It appears that the only *published* rule of Mr. Peake's is that of which we gave a brief outline to our readers in our last week's Number, and Mr. Atherton expresses his belief that it will be more highly appreciated by us when better understood than at present, and Mr. Peake himself says, that in our judgment of its value we have been 'grievously misinformed,' for throughout the little work in which it is contained there is 'no restriction to the curvilinear portions of the sectional areas being divided into triangles and curvilinear areas to any extent, leaving actually no deficiency in measurement; and to obtain the greatest distance between the two chords and the curve by trial, is evidently a matter of manipulation.'

"Now, as far as regards the *simplified* method of calculating the area of sections, as developed in the little work in Weale's Series, one definite method, and one only, viz., that which we laid before our readers, was proposed. By this the area is divided into two triangles and *two* curvilinear portions, which are assumed to be parabolas. No *hint* whatever is given of the propriety or advisableness of dividing it into a larger number of triangles and curvilinear portions.

"We think, therefore, that the great bulk of the readers of that little work, who are supposed to be beginners like ourselves, would rise from the study of it with the impression that it was essential to the simplicity of the rule, that the area should be divided into two triangles and two curvilinear portions, and no more. As far, therefore, as any *published* rule of Mr. Peake's is concerned, we cannot allow that we have been grievously misinformed; and we cannot withdraw our remarks on the rule *as published* in the little book in question.

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* This is in allusion to a letter from Mr. Peake, the Assistant Master Shipwright of her Majesty's Dockyard, Woolwich. The purport of this letter (which is published in the *Mechanics' Magazine* of this day) will be gathered from our remarks upon it.—ED. M. M.

"It seems, however, that since Mr. Atherton has been devoting his attention to the correction of the principles of shipping registration, Mr. Peake has been applying himself to the simplification of the details of the actual measurement. He has sent us a little book, of 22 small pages, in which his efforts to attain this desirable end are developed. This little book, however, is not published, but only privately printed; and it would seem that Mr. Atherton's remarks really alluded to the extension of the former method, as set forth in this book.

"Mr. Peake expressly informs us that his sole object in this little treatise is, to *simplify* the method of calculations, so as to bring it more within the acquirement of the novice than Sterling's rule.

"How is this object supposed to be effected? By a series of independent calculations for each transverse section, which substitutes triangles for trapeziums, and a series of parabolic areas, all of which have to be calculated separately.

"If the calculations on Mr. Peake's principle be correctly made, they ought to produce a result identically the same as that given by Sterling's rule, for the *principle* of calculation is identically the same.

"We have already shown how any one, possessed of a very moderate amount of geometrical knowledge, may convince himself, with the greatest ease, of the close approximation which Sterling's rule gives him to the area of a curve. All the information he was supposed to bring with him for that purpose, was the common expression for the area of a parallelogram and that for the area of a triangle.

"Mr. Peake's requires his tyro to be further cognizant of the expression for the area of a portion of a parabola. To have an *intelligent* knowledge of this, the student *must* know something of the theory of limits, either geometrically or analytically. He *must*, therefore, be further advanced to understand Mr. Peake's than to understand Sterling's rule.

"Every transverse section of Mr. Peake's method is divided into *one* parallelogram, several triangles, and several parabolic areas, each of which has to be calculated separately.

"Take the example which he gives—the *Coquette*, and her midship section. His method, first of all, requires the curve to be laid down accurately to a scale. It is then divided into a parallelogram, three triangles, and three parabolic areas; to do which, eight lines have to be drawn, and three others estimated by aid of the compasses; and, of course, five independent calculations must be made.

"To perform the same operation by Sterling's rule, five, or at most seven, breadths, must be measured at equal intervals; and the rule is applied at once by four operations, as has been shown.

"Besides, for the purposes of tonnage admeasurement, there is an important difference of simplicity in the plans. By the authorised rule, the officer entrusted with the duty has only to enter *his measurements* in a book. By Peake's rule, besides the number of *independent* calculations to be made, he must first make a delineation to a scale of the length of the vessel, and then of the depth of the several transverse sections, and to each depth as a base line set off the line form of the section (the most accurate mode of doing which is by ordinates), and *after all this* he must draw his eight independent lines and estimate his three others.

"How any one can seriously propose this as a more simple and more intelligent rule than Sterling's, and one better adapted to a novice, passes our comprehension! In point of correctness the rules are on a par.

"We have no wish to depreciate either Mr. Peake's or Mr. Atherton's labours; but really, when the object sought is simplicity, and so much parade is made of the wonderful improvement which Mr. Peake's mode is upon Sterling's in this respect, our risible faculties are excited, and we are forcibly reminded of Horace's well-known line, *Parturiunt montes; nascitur ridiculus mus!*"

The following reply has been addressed by Mr. Atherton to the Editor of the *Mechanics' Magazine*:—

Woolwich Dockyard, June 23rd, 1856.

Sir,—In your editorial article on "Tonnage Registration," published in the *Mechanics' Magazine*, No. 1715, in connection with my letter of the 17th instant, inviting the Editor of the *Mechanics' Magazine* to announce his decision, "and take a decisive part, either in upholding our shipping registration system as it now is, or declare himself an advocate for its amendment," you have now most satisfactorily, because plainly, responded to this invitation, by declaring your views as follows:—"If we consent to give in our adherence to the principle of remitting any questions connected with shipping registration to the action of 'consultative deliberation,' they must be entirely by way of *addition* to, not of *alteration* of, the registration clauses of the Merchant Shipping Act, so far, that is, as sailing ships are concerned."

Then, as to the registration of steamers:—"We believe the owners of sailing vessels generally feel this part of the law (referring to the exclusive measurement of steamers) as a great grievance, and we are, on the whole, disposed to concur in this opinion, which seems also to have been shared by the Tonnage Commission of 1849."

Then again, conclusively—"We should have no objection to see, or rather we should say, we should see with satisfaction, a competent Committee appointed by the Government, or by the British Association, or some other scientific Society, in the first instance, with a view of ultimately, if need be, acting on the Government to take into consideration the following points."

These declarations, by the Editor of the *Mechanics' Magazine*, constitute grounds on which this discussion on Tonnage Registration ought, on my part, to be brought to a conclusion. I regard these declarations as displaying the candour, judgment, and desire to serve the public in the cause of science, which have always characterised the editorial conducting of the *Mechanics' Magazine*; and thanking you, the Editor, for having given publicity to, and now so powerfully confirming my exposition of the deficiencies of our present system of Statistical Shipping Registration, I am, &c.

CHARLES ATHERTON.

MEETINGS FOR THE ENSUING WEEK.

Thurs. Zoological, 3.
Sat. Asiatic, 8½. Lt.-Col. Sir. H. C. Rawlinson, "On the City of Babylon."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 14th and 16th June, 1856.

Par. No.
193 (1). Pimlico Improvements—Copy of Report.
193 (2). Spitalfields Road—Copy of Report.
238. Railways Companies—Returns.
273. Malt—Return.
274. Supply—Account.
279. Army—Supplementary Estimate.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette June 20th*, 1856.]

Dated 22nd March, 1856.

689. Charles Carey, 32, Union-grove, Wandsworth-road—Improvement in omnibuses.

Dated 23rd April, 1856.

969. Isaac and George Myers, Rotherham—Improved "fire-lighter."

Dated 25th April, 1856.

997. Robert Lakin, Stretford, Lancaster, John Thompson, Edward Gerrard Fitton, and Frederick Alexander Fitton, Ardwick, Manchester—Improvements in or applicable to certain machines for preparing and spinning cotton and other fibrous substances, some of which improvements, relating to apparatus for lubricating, and to the construction of studs, are also applicable to machinery for other purposes.

Dated 13th May, 1856.

1123. Alexander Parkes, Birmingham—Improvements in the use of collodion in photography.

Dated 14th May, 1856.

1145. William Evans, Sherston, Malmesbury—Improved description of plough.

Dated 16th May, 1856.

1160. Joseph Martin, Liverpool—Improvements in machinery for draining or partially drying certain descriptions of wheat and other grain.

Dated 21st May, 1856.

1199. Robert Pemberton, Hildenborough, Tonbridge—Improvements in barrel organs.

Dated 23rd May, 1856.

1296. John Gedge, 4, Wellington-street South, Strand—Improvements in the means of adjusting the parts of ladies' dresses called "crinolines" and "sousjupes." (A communication.)

Dated 2nd June, 1856.

1299. Gustavus Gidley, 14, Clinger-street, Hoxton, and William Christopher, 2, Oak Villa, Pinner—Reducing the bottle or imported india rubber to a transparent liquid state, so that it may be used as a transparent varnish or solution for mixing with colours.

1307. Delia Avery, Essex-street, Strand—Improvements in the construction of bonnets and other coverings for the head.

1312. George Hallen Cottam and Henry Richard Cottam, St. Pancras Iron Works, Old St. Pancras-road—Improvement in the manufacture of iron hurdles.

Dated 4th June, 1856.

1325. Thomas Morris, Bunney, Nottingham—Improved trap for beetles and other insects.

1326. Frederick Albert Gatty, Accrington—Instrument to be used in lighting and holding matches or vesta lights.

1327. Adam Bullough, Blackburn—Improvements in the mode or method of leasing warps.

1328. William Potts, Handsworth—Improvements in sepulchral monuments.

1329. Reuben Boyce Wigley, Birmingham—Improved method of attaching handles to coffins.

1330. Edward Hatton, Birmingham—Improvements in the manufacture of plain and ornamental metallic tubes.

1331. Duncan Morrison, Bordesley Works, Birmingham—Improvements in the manufacture of metallic bedsteads and other articles to sit or recline on.

1332. Charles Louis Marle, Hotel du Continent, 46, Leadenhall-street—Improvements in preserving animal and vegetable substances suitable for food.

1333. Duncan Morrison, Bordesley Works, Birmingham—Improvements in the manufacture of articles from malleable cast iron.

1334. John Christophers, Heavitree, Devon—Improvement in knives and forks whose handles are not metallic.

1335. Richard Archibald Brooman, 166, Fleet-street—Improvements in plating glass to render it reflective. (A communication.)

1336. William Smith, 82, Margaret-street, Cavendish-square—Improvements in apparatus for regulating the supply of air to furnaces.

1337. Alexandre Louis Gibon and André Frohlich, 39, Rue de l'Echiquier, Paris—Improvements in economising fuel in the treatment of metals.

Dated 5th June, 1856.

1338. John Betts, Strand—Improvements in the preparation or manufacture of artificial spheres.

1339. John Norris, jun., New York—Improvements in the manufacture of the cutting tools employed in nail making machines. (A communication.)

1340. Jules Le Breton, 18, King's Arms Yard, Coleman-street—A photo-gas or apparatus, with air draughts of hot oxygen when applied to oil lamps, with wicks for lighting and heating. (A communication.)

1341. Andrew Edmund Brae, Leeds—Improvements in apparatus for communicating signals from one part of a railway train to another.

1342. Archibald Sinclair, Birmingham—Improvements in wrought-iron pins for railway chair fastenings.

1343. William Watson Hewitson, Headingley, near Leeds, and William Hamond Bartholomew, 15, Brunswick-terrace, Leeds—Improvements in the construction of the furnaces or fire-boxes of tubular steam-boilers.

Dated 6th June, 1856.

1345. Duncan Lang, Greenock—Improvements in obtaining and applying motive power.

1346. Joseph Robinson, jun., Hyde, Chester—Improvements in railway chairs, or in means for securing rails thereto.

1347. Charles Beyer, Gorton, near Manchester—Improvements in locomotive engines.

1348. Robert Harlow, Stockport—Improvements in the construction of water-closets, and in valves or taps for water-closets and other purposes.

1349. James Somerville, Glasgow—Improvements in weaving.

1350. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvements in machinery for extracting fibrous and other products from vegetable substances. (A communication.)

1351. John Juckes, Dame-street, Islington—Improvements in the furnaces of locomotive boilers.

1352. Thomas Chambers, junr., of Colkirk, Fakenham—Improvements in agricultural drills.

1353. Peter Armand le Comte de Fontainemoreau, 31, Rue de l'Echiquier, Paris—Improvements in heating water for steam boilers. (A communication.)

1354. Alfred Vincent Newton, 66, Chancery-lane—Improvements in rotary engines. (A communication.)

1355. Paul Ellison, St. Helen's, Lancashire—Improvements in furnaces, and the mode of working the same, for the manufacture of black ash or crude soda.

Dated 7th June, 1856.

1356. Adam Stamm, Buenos Ayres—Improvements in presses for packing, parts of which improvements are also applicable to other presses.

1357. Alfred Vincent Newton, 66, Chancery-lane—Improved furnace for heating soldering irons. (A communication.)

1358. William Edward Wiley, 34, Great Hampton-street, Birmingham—Improvements in the manufacture of metallic pens and penholders.

1360. Samuel Dyer, Bristol—Improvements in reefing, furling, and setting the sails of ships and vessels, also for protecting such sails from wet and other abuses caused by ropes and rigging.

Dated 9th June, 1856.

1361. Alexander Robertson, Dublin—Improved inkstand.

1362. Joseph Bennett Howell, Sheffield—Improvements in the manufacture of cast-steel tyres for railway locomotive engine and carriage wheels.

1363. Charles William Siemens, 7, John-street, Adelphi—Improvements in engines wherein superheated steam is used.

1364. William Field and Edward Jeffreys, Shrewsbury—Improvements in machinery for sewing seed and for distributing manure.

1365. Robert Ferrier, Jedburgh—Improvements in machinery or apparatus for sweeping and cleansing roads and streets.

1366. James Holdin, Manchester—Improvements in machinery or apparatus for washing rags, which said improvements are also applicable for washing other materials.

1367. James Holdin, Manchester—Improvements in machinery or apparatus for bowking, bleaching, dyeing, and washing textile fabrics or materials.

1369. John Ellis, Heckmondwike—Improvements in the manufacture of muriate of ammonia and carbonate of ammonia, and in converting certain ingredients employed therein, into an artificial manure.

1370. Benjamin Smith and William Kalthoff, Gemund, near Cologne—Improvements in economizing fuel in locomotive and other steam engines.

1372. Richard Archibald Brooman, 166, Fleet-street—Improvements in ladies' wearing apparel. (A communication.)

Dated 10th June, 1856.

1373. Thomas Skaife, Vanbrugh-house, Greenwich—Spring folding camera shutters for the more speedy and convenient mode of taking photographic pictures than has been hitherto adopted.

1375. Richard Archibald Brooman, 166, Fleet-street—Improvements in printing shawls and other fabrics, and in the machinery employed therein. (A communication.)

1379. Charles Rowe Cheshire and Joseph Betteley, Liverpool—Improvements in the manufacture of anchors.

1381. Alfred Vincent Newton, 66, Chancery-lane—Improvement in projectiles for ordnance. (A communication.)

INVENTION WITH COMPLETE SPECIFICATION FILED.

1410. Hector Grand de Chateauneuf, Paris—Improvements in apparatus for washing and bleaching clothes and other materials, to be called "the steam washing lixiviateur."—14th June, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed June 20th, 1856.

2891. Bernard Hughes.
2892. Matthew Tomlinson.
2893. Charles James Appleton.
2903. William Stevenson and William Crawford.
2908. David Dick.
2952. Sir John Scott Lillie, C.B.
25. Colin Mather and Charles Millward.
109. Samuel Sheppard.
142. François Jules Manceaux.
205. Gentle Brown.
775. Thomas Waller Burrell.
851. William Edward Newton.
869. James Burnside.
905. Frederick Priestley.
917. Lianna Mesure.
941. Thomas Wilkes.
963. Christopher Nickels and James Hobson.

Sealed June 24th, 1856.

2925. Charles May and Edward Alfred Cowper.
2927. Edward Alfred Cowper.
2943. Herbert Redfern.
2949. Silvester Lees and Edward Lees, and George Henry Newton.
5. William Beckett Johnson.
9. William Bullough.
26. James Frederick Lackersteen.
41. Robert Sam North and Ralph Peacock.
44. Henry Bessemer.
55. Rd. Archibald Brooman.
161. Gustav Adolph [illegible].
193. George Brooks Pettit and Henry Fly Smith.
217. William Dreschfeld.
244. Joseph Fowell Walton and Honore le François.
304. Nathan Ager.
385. Edmund Morewood and George Rogers.
643. Edward Rowley and John Hadley.
684. William Henry Barlow.
890. William Warren and Warren De la Rue.
912. William Little.
923. William Tytherleigh.
945. Wm. Crosley and George Goldsmith.
954. James Hansor.
973. William Peacock Savage.
977. James Barbour.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

June 16th.

1572. James Tatlow and Henry Hodgkinson.

June 17th.

1488. Thomas Adamson and William Adamson.
1515. Charles Cowper.
1582. William Tasker.

June 18th.

1484. Henry Saunders.
1503. Wm. Boggett and George Brooks Pettit.
1525. Charles Topham.

June 19th.

1504. Wm. Hodgson and Henry Hodgson.
1537. George Sands Sidney.

June 20th.

1505. John William Perkins.
1555. John Mason and Luke Ryder.

June 21st.

1531. Peter Armand le Comte de Fontainemoreau.
1583. Richard Bradley and William Craven.

Journal of the Society of Arts.

FRIDAY, JULY 4, 1856.

MEETING OF COUNCIL.

Wednesday, July 2, 1856.

The Council held their first meeting this day since their election; Colonel Sykes, F.R.S., was elected Chairman for the current year.

The following gentlemen have been nominated Honorary Local Secretaries:—

William Axon, Esq., for Chester.
William Sands Cox, Esq., F.R.S., for Birmingham.
John Darlington, Esq., for Bradford.
William Telkin, Esq., for Nottingham.
Henry Newall, Esq., for Rochdale.
W. M. Tartt, Esq., for Cheltenham.
John Waterhouse, Esq., F.R.S., for Halifax.

As there are at the present time many gentlemen proposed as members who, under the bye-laws, cannot be balloted for until the Society's meetings commence again in November, the Council have directed the Secretary to forward the *Journal* to those gentlemen in the meantime.

The following Institutions have been taken into Union since the last announcement:—

418. Bradford Chamber of Commerce.
419, Sheffield Free Library.

EXEMPTION FROM RATING.

The Bill now before Parliament, for amending the law relating to the exemption of Institutions from local rating, came on for discussion in the House of Commons on Wednesday last, and was well received by the House. The numbers voting in favour were 117; against it, 25. It was arranged for its going into Committee, *pro formâ*, the following day (Thursday), for the purpose of inserting certain amendments. On Wednesday next the Bill again comes on, and from the almost unanimous feeling of members in favour of its object, there is every reason to hope that it will be successful.

ON THE GROWTH OF WINE IN NEW SOUTH WALES.

The following letter has been received from Mr. James King, to whom the Society's Silver Medal has been awarded "for the importation of wine the growth of the vineyards in New South Wales:"—

[These wines consist of four sorts, three white and one red; of the three white wines, two are pronounced by the Society's Committee as satisfactory. One of these is considered to be of fair quality, much resembling *good* Cape wine, but light; the other as good, fair, marketable quality, dry and clean, with considerable body. The red wine is very light, clear tasted, somewhat resembling Bordeaux.]

London, 14th December, 1855,
No. 8, Suffolk-street.

Sir,—In compliance with the wishes of your Society, I have the honour to submit to its examination four quarter-pipes of wine, the growth of New South Wales, made by me during the years 1853 and 1854, at Irrawang, in that colony. This wine was imported by me, about two months since, from Sydney, in the ship *Speedy*, now stored in her Majesty's bonded warehouse, London Docks. I also enclose an order, as you suggested, for tasting and examining the wine there.

By the published rules of the Society, full particulars regarding all colonial articles submitted for examination are properly required; and at present more especially in the case of wines, since that important commercial article has lately so far ceased to be produced by many of the old wine-growing districts of Europe. I, therefore, take the liberty of laying detailed particulars before the Society touching the wine in question, and generally regarding the cultivation of the grape vine in New South Wales.

With regard to the district of the Hunter, in New South Wales, which produced this wine, it consists of the coal formation, overlaid in many places by remote overflowings of volcanic trap, interspersed by tracts of pudding-stone and porphyry. And with reference to the vineyard at Irrawang, where the wine grew, it is situated about three miles equally distant from the navigable rivers Hunter and William.

The soil is that resulting mainly from the decomposition of part of the porphyry and pudding-stone already mentioned. It has been wholly turned over with the spade two-and-a-half feet deep, the top soil being thereby placed at the bottom. The soil varies considerably. Some parts consist of light sandy loam; at other places, of a rich black mould, with a considerable proportion of clay and gravel in its composition. The vines planted as cuttings in 1834 grew freely, but it was not considered fit for them without being previously trenched. The aspect lies to the sun, being north and north-easterly, with considerable inclination in some parts, and elevated about 100 feet above the sea level.

The mode of culture is as follows:—The plants (cuttings originally) are in rows six feet apart, and generally four feet apart in the rows, supported by a single stake four feet out of the ground, generally pruned to short spurs, which mode seems best suited to the climate. The whole ground is dug over one spit in winter with the spade, manured where the growth has become weak, and kept from weeds in summer with the caste, hoe, and spade; all superabundant shoots and fruit are removed as soon as formed; the pruning is generally so managed as to prevent, as far as possible, the removal of either being necessary. The pruning is commenced as soon as the leaves fall; but never carried on after the 1st of August. It ought to be finished as early as possible. Nor is the soil of the vineyard ever moved about that time; the sap of the plant then begins to circulate, and would be apt, in some seasons especially, to flow from any wounds made in the roots or branches, and thereby weaken the future growth of the plants. This experimental vineyard, now alluded to, consists of about six acres. Nine acres were also planted on another spot, which did not require trenching; and four acres, by way of another experiment, were planted on rich alluvial land, on the banks of the William.

No cultivated land, however rich, can be said to be exhaustless—to be ever fertile; the continued removal of crops from its surface, without addition, must in time abstract from it a large proportion of those constituents of the soil essential to their production. When they have been so reduced in quantity, and when merely mechanical turning over and subdivision of the soil have at length failed to render it sufficiently productive (for these operations are well known to have a limit to their influence), recourse must then be had to *proper manuring*, to restore the ingredients that have been so abstracted, so as again to render the soil productive.

The grape vine, although long-lived, from its ability to extend its roots far in quest of nourishment, is, nevertheless, like other organic beings, subject, from deficiency of food, to premature disease, decay, and death; and that deficiency we must make good, sooner or later, in our vineyards, wherever they may be, in order to prolong their health and even existence, and at a period, too, in proportion as their soil was originally poor or rich in the elements essential to the healthy growth of the vine. Overlooking altogether these considerations, or treating them too lightly, may possibly be the reason of the late failures of the wine crop in the old vineyards, rather than in the effect of changed atmospherical influence, as the supposed cause. Careful scientific investigation of the facts and circumstances may possibly discover the true cause, and thereby enable investigators to suggest an effective remedy.

With regard to the kinds of grapes already in the colony, they consist of a vast variety, having been from time to time imported from various parts of the continent of Europe, many of which I have planted, and found them unsuited to the climate, although of high reputation in France. I am still experimenting, to discover, if possible, the best sorts of grape to plant for wine in the colony. I have at last discarded all European recommendations in favour of particular varieties, and I am endeavouring to find out what character some of them really merit in New South Wales alone. This can only be determined by time and local experience. I have heard with astonishment persons of experience in France state, with great confidence, that such and such a grape should be cultivated in New South Wales, whilst, at the same time, they were utterly ignorant of the climate of that country, on which so much depends. The produce of the same grape in different countries is therefore dissimilar.

My humble opinion now is, that the grape which grows freely, bears well, most regularly, and at the same time brings its fruit to the highest perfection in that climate (no matter what its foreign character may be), is the grape that will produce the best wine, and be the most profitable to cultivate in the colony; and that is the grape I have been seeking for. I have therefore at present planted Gonais, Verdeilha, and Shepherd's grapes, most extensively, for the growth of white wine; and Black Pineau, Grey Pineau, and Lambrusquat, for that of red wine. Other varieties may yet be found superior to these, and in proportion, too, as the grape vine is acclimatised to the locality, with the greater probability.

Making the wine requires more care and judgment on the part of the wine-grower than any other part of his business. At Irrawang, the ripe fruit is gathered first into glazed earthen flat dishes; the unripe and damaged berries being then pinched off, and thrown away; the bunches are then thrown into tight tubs, and carted to the wine-house; the stalks are partly removed, and the whole of the grapes broken. The fruit so reduced to a half liquid mass is immediately thrown into tubs of about 150 gallons each, and therein allowed to ferment, which commences spontaneously, and is sufficiently advanced in from one to three days (according to the temperature) for the wine to be drawn off into casks, where it completes the fermentation. There can be no fixed period for the continuance of that process, since it is modified by the temperature of the place, temperature of the juice, state of the atmosphere, chemical composition of the must (which differs every season), the bulk of the mass operated on, &c. &c. The fermentation now proceeds more slowly in the casks, the wine having been partially cooled by the mere drawing off; when it ceases altogether, the bungs are put down tight, taking care to keep the casks full. The skins, &c., left in the tubs, after drawing off the wine, are immediately pressed, but first removing all that have become acid. The liquid which flows from them by the pressure is preserved apart from that which has been drawn from the tubs as an inferior wine. The skins, &c., are now removed from the press; a little hot water is thrown over them, enough to moisten them well; they are again submitted to pressure, and what liquor is now squeezed from them is, at a convenient time afterwards, introduced into the still, from which brandy is procured.

When the wine becomes still in the casks, the insoluble ferment settles at the bottom; the wine is then drawn into clean casks, previously well smoked with burning sulphur; and this drawing is done as often as there is any considerable deposit found, and the more frequently when the wine remains turbid; in that case a little fining is added.

There are many reasons why this racking, as the experts call it, should only be done in cool weather; carefully observing all along what has already been mentioned, to keep the casks full and the bungs tight. The wine is now left to the slow operation of arriving at maturity.

Such is the process by which the wine under examination was made, being the mode now always practised at Irrawang.

The maturation process consists of various spontaneous chemical changes which the wine undergoes at a moderate temperature; and these decidedly improve its quality. When the degree of that temperature is too low, the process of amelioration is stopped or retarded; and when too high, other processes may be generated, which will deteriorate the quality of the wine. At the same time these actions, involved in perfecting the wine, are exceedingly slow, and cannot be greatly facilitated by art. All that can be done is to rack the wine occasionally, always into sulphured casks, at the same time exposing it to the air when the atmosphere is near 45° of temperature; when above that degree, exposing it as little as possible. Store it in temperate still cellars, and leave it to time.

The principal changes which wine thus undergoes, during the ripening process, are—it loses a portion of its sugar, which is converted into alcohol; a part of its free acid, in the shape of tartar, is precipitated; and another part combines with some of the alcohol, to form a peculiar æther (œnanthic), which gives the esteemed bouquet to all wines; the remaining leaven, which is apt to cause the formation of acetic acid, becomes oxidised, and is precipitated in an inert state. A portion of the water is slowly evaporated through the staves of the cask, whilst the alcohol is retained; the contents thereby become stronger. Wine, if red, loses some of its colouring matter, &c., &c. There is a well-known law of nature however, affecting materially the operations of the wine-maker in many stages of his process, from the fermentation of the juice to the disposal of the wine in bottle, viz.:—

Chemical action is active in proportion to the volume of the mass acted on; other conditions being the same, it hence follows that wine in a large mass will ameliorate more rapidly, and develope qualities more completely than in a small one. It ought to be contained, therefore, in large vessels till that effect is produced. It may take only a few months, or it may take a series of years, to arrive at sufficient maturity. This depends on the original composition of the wine, the heat of the climate, and other modifying causes. When the wine has at length been sufficiently so perfected, it is necessary to arrest or retard, if possible, this chemical process, which constitutes the ripening to maturity. For that purpose, and in accordance with the law already stated, the mass must be reduced in bulk; and the most convenient mode of accomplishing this, is that which is generally adopted, the drawing it off into common bottles, corking them well, and packing them away in a cool cellar, to remain till the wine shall arrive at perfect maturity. In this case, it may remain a longer or shorter period. But wine forms no exception to the universal law, and therefore the quality which is common to all dead organic substances, to resolve themselves, under ordinary circumstances, into their elementary forms, and which, in the case of wines, aids in its formation, will assuredly, in time, accomplish its destruction. It must not, therefore, be allowed to lay in the cellar too long, for the same chemical decomposition which formed the wine, and promoted its progress to maturity, will in course of time, even in bottle, as certainly cause its deterioration and decay.

The quantity of wine I have hitherto produced is comparatively limited, seldom above 2,500 gallons a-year. I could easily have extended my plantations, but I did not, waiting the result of the first experiments in wine-growing and making. I have latterly sold readily in the colony all I could make, and even had several small orders for England, from persons I was known to, which I supplied. In one instance, I could not supply the quantity ordered. In the year 1850, I sent samples to my friend Baron Liebig, now at Munich, who replies in his letter from Giessen:—

"The wine Pineau Noir, Tinta, and Pineau Gris, indicates a specific gravity ·9920, produces in 100 volumes 16·20 of alcohol; in the same volumes, ·505 free acid, 3·265 dry residue, and ·498 of incombustible ashy constituents. The other white sort (Irrawang) has a specific gravity ·940, contains in 100 volumes 13 volumes alcohol, ·660 free acid; 100 volumes yield by evaporation 3·313 dry residue, which consist principally of saccharine matter, and ·563 ashy constituents. These proportions are met with, in Germany and France, in the moist choice wines. Both sorts contain more alcohol, and less free acid, than the most esteemed Rhenish wines. The soil on which these wines are grown must contain much calcareous matter, for they approach in flavour the wines of Hungaria and Franconia. The red wine has many properties in common with Burgundy."

In a subsequent letter from Giessen, being a reply to one from me, mentioning a mode of effecting, in some cases, a more complete fermentation of grape juice, which I had suggested and adopted, Baron Liebig is pleased to say:—

"Your proposal of mixing the must of the Verdeilho grape with the juice of the Gonais is excellent, and quite adapted to point out the way in which improvements may be effected. This proposal evinces how much you have reflected on the process of wine-making, and how thoroughly you are acquainted with its principles."

Last year I sent a few samples of my wine to Paris, consisting principally of vintages 1846, 1851, and 1852 (the local Government having solicited from the colonists contributions for the Paris Exhibition); they were tasted in Sidney along with many other samples previous to shipment, by the Sydney Paris Commissioners, or a Jury appointed by them for that purpose. Mr. Macarthur of Camden and myself only were then awarded the highest medals each, for having there exhibited the best New South Wales wines intended for the Paris Exhibition.

On the same wines being presented at the Exhibition in Paris, Professor Owen happened to be selected and solicited as a Juror to report on all wines exhibited; the following is an extract from that gentleman's report:—

"In the department of Australia (New South Wales), the evidence of the increasing importance of the vineyards of that colony, in the specimens of the wines exhibited by Messrs. Macarthur, King, and Brown, is deserving of special notice.

"The wines include white wines, akin to those of the Rhine; red light wines like those of Burgundy; Mousseux varieties with a bouquet body, and flavour equal to the finest champagnes; Muscats and other sweet wines rivalling the Montignac of the Cape."

"Some of these wines were of the vintage of 1839, bottled in 1842; others had made the voyage round the world in wood. The verdict of the experts was much in their favour, for whereas on the wines of Europe, the numbers indicative of quality ranged from as low as 2 to 18, the lowest number assigned to the Australian specimens was 7, the highest 15, and the average number was 14½, being as high as that of the wines of Austria, and much exceeding that of the wines of the Cape or any other wine-producing colonies."

The ultimate result of the Jury's report on any of these wines was not known while I was in Paris where I remained nearly a week after the closing of the Exhibition, and I have not been informed of it since my return to London. Mr. Macarthur, of Camden, however, has kindly promised to inform me as soon as it comes to his knowledge.

At the time I forwarded the samples to the Paris Exhibition, I also forwarded duplicates of them to Baron Liebig, at Munich. A few days after my arrival in London from Sydney, I saw that gentleman here, then on his way to Munich. He emphatically remarked, that my wines which he had received *were very much improved in quality* since he received the previous samples, and that we would enter fully into their merits when I visited him at Munich.

There is a very prevailing opinion in England, that the wine growers of New South Wales lose sight of their interest by attempting to produce wines resembling the finer growths of France and Germany—a very laudable desire, in my opinion, but I cannot see how they could so injure their interests even if it were the case. It is true their wines happen naturally to resemble, in some degree, the wines of these countries, and it is out of their power to make them more resemble any other. The must of the grape is a complex substance, its composition and qualities are determined by the locality which produces it, unlike the wort of the brewer, a simple artificial compound, variable anywhere at his will, to meet the taste of the consumers of beer. For my own part I may say that I have all along, by minute care and attention, aided by the best information I could procure on the subject, endeavoured to render my wine of as good a quality as possible, so that it might command the most ready sale (and without injury to the quality) in as great a quantity from the acre as would render the business as profitable as possible, and others in their own way, I suppose, have done the same. It would be quite possible, I dare say, to pass it off by foreign names, but not by the grower. I have never attempted to do so, but ever allowed the wine to recommend itself on its merits, giving it no other name than "Irrawang," the name of the property on which it is grown.

I have every reason to believe that the wine of New South Wales possesses great durability; it has, when perfectly sound, improved much by age; unsound wine will not keep. In 1836, I made my first wine, red and white, from plants which had only then been eighteen months planted, and at the time of planting they were merely rootless cuttings. The wine was made in the usual way, racked, fined, put into casks (one of each only), and soon bottled. It continued to improve in quality up to May last, when I tasted the red variety at Irrawang, it then resembled a fine high-flavoured Burgundy. The white variety was all used some years ago; it was equally superior, resembling fine hock. At the time alluded to, only two bottles of the red wine remained; and, unfortunately, my cooper broke one in packing them for me to bring to London. If the other bottle is not broken in its carriage to England, and when I get it out of bond, it will give me much pleasure to present it to the Society for its information, along with a bottle or two of sweet wine, rendered so by boiling the must.

There are a number of wine-growers in various parts of the colony, some of whom produce much more wine than I do; and those vineyards which are planted on alluvial land are very much more productive than mine, averaging at least 1,000 gallons, or even more, per acre, whilst the average product, you may know, of the whole vineyards of France does not exceed 270 gallons per English acre. There is a vast quantity of waste land in New South Wales, eminently fitted for the production of wine of good marketable quality, more especially now since we are aware, by the samples produced, that the climate also is suited for its production.

The discovery of the existence of the gold deposits in the colony have, however, greatly retarded the further formation of vineyards, by raising the price of labour.

But New South Wales will yet, nevertheless, be an extensive wine-growing country, without trenching in the least upon the production of wool, its present staple product, where the many thousands who are annually emigrating thereto, and to Victoria, cannot fail to find profitable and steady employment altogether independent of the gambling allurements of the gold mines, where the advantages, even to the labourer, on the average, are now very questionable indeed.

The wine of New South Wales will improve by a long voyage more rapidly than by lying in the cellars; no time will, therefore, be lost in transmitting it, by length of the voyage, to market. Besides, it will form dead weight for ships carrying wool to England, whilst at present a high price has to be paid in Sydney for sand-stone ballast, useless here, and which has, at some expense, to be removed from the docks.

No nation in the world possesses, or can command, such appliances as Great Britain, to render New South Wales an abundant wine-growing country. She has vast resources in capital, in people, in ships, in stores, with unbounded land in the colony as a reimbursement. She has markets, too, all around, for the various produce of her colony, and thus a great increased demand will consequently be produced for her manufactures in the colony itself, whilst she will enjoy the high satisfaction of rendering, and with profit to herself, a portion of a partially slaving and starving population prosperous and happy. The cultivation of the soil, conducted with intelligence and industry, in producing any article of exchangable value, actually converts every acre of land so employed into a lasting source of wealth, more especially in New South Wales, where much of the best land lies in a state of nature. Even gold-fields, however productive at the outset, are necessarily of circumscribed limits and of exhaustive productiveness. There, working, from exposure, excitement, anxiety, and fatigue, is injurious to the constitutions of men; and the sadly demoralising influence on the majority of those attracted thither, will be traceable through successive generations, even after gold digging has long ceased to be the pursuit of their offspring. With agriculture, no limit can be well assigned to its extent or its productiveness, either in abundance or duration. It constitutes the only durable source of a country's wealth. Poor and degenerated must that community eventually become, which has only its mineral resources to depend on; for that which cannot be reproduced will not render a country permanently great; whilst the physical health of an agricultural community, and the play of domestic and social feelings attendant upon rural occupations, lead to a state of society promotive of comfort and happiness, and render the country the reception of all the influences and institutions of civilised life.

I have the honour to be, Sir,
Your most obedient and humble servant,
JAS. KING.

GOVERNMENT GRANTS TO SOCIETIES AND PUBLIC ESTABLISHMENTS.

A return has lately been made, in pursuance of an order of the House of Lords, dated 5th May, 1856, for "a return of all sums granted in the five years ending 5th April, 1856, to the Royal Society, Antiquarian Society, British Museum, Establishment at Marlborough House, Geological Society, Society of Arts, Entomological Society, and Zoological Society; distinguishing each year, with the manner in which such sums have been expended, distinguishing the salaries or other remunerations given out of the same."

By this return, it appears that the Royal Society has received a grant of £1,000 per annum for the last six years. The details are given in the return; and out of the £1,000 granted for the last year, £780 have been expended as follows:—To Mr. Bachforth, for calculations to be made for comparing the results of experiments on capillary attraction with theory, £50; to Dr. Miller, for the construction and verification of standard meteorological instruments by the Kew Observatory, £100; to Dr. Salter, for inquiries in experimental physiology, £50; to Dr. Frankland, for continuation of researches on organo-metallic bodies, £100; to Mr. Fairbairn, for experiments on boiler explosions, £300; to Mr. Hodgkinson, for prosecuting experimental inquiries on the strength of materials, £100; to Dr. Carpenter, for researches in marine natural history, £50; to Mr. Baxter, for researches in electro-physiology, £30; total, £780; leaving a balance on hand, Jan., 1856, of £148 9s. 4d.

The Antiquarian Society states that "no sum has ever been granted by the Treasury to this Society."

The British Museum has expended during the year ended 31st March, 1856:—Salaries, &c., £26,058 13s. 2d.; house expenses, £2,480 11s. 6d.; purchases and acquisitions, £14,697 7s. 2d.; bookbinding, cabinets, &c., £12,025 15s. 6d.; printing catalogues, making casts, &c., £1,780 5s. 4d.; law expenses, fees, &c., £96 13s. 8d.; excavations, &c., in Assyria, and transport of marbles, £882 18s. 3d.; purchase of the Bernal antiquities, £3,981 16s.

The establishment at Marlborough House returns an expenditure as follows:—1st April, 1851, to 31st March, 1852, £19,098 18s. 4d.; 1st April, 1852, to 31st December, 1852, £14,643 16s. 1d.; 1st January, 1853, to 31st December, 1853, £26,595 11s. 7d.; 1st January, 1854, to 31st March, 1854, £8,084 6s. 9½d.; 1st April, 1854, to 31st March, 1855, £56,911 10s. 1½d.; 1st April, 1855, to 31st March, 1856, £81,384 17s. 8½d.; making a total in the five years of £206,719 0s. 7d. These sums include, since the year 1852-53, the expenditure on account of the Geological Surveys, (Great Britain and Ireland) Museum of Practical Geology, Jermyn-street; Museum of Irish Industry, Dublin; Designs Office; Industrial Museum, Scotland; Royal Dublin Society; Meteorological Observations at Sea. The sum expended during the last year appears to have been £81,384 17s. 8d., divided under the following heads:—General management, £4,597 10s. 6d.; Department of science and art, £38,495 16s.; Schools throughout the kingdom in connection with the Department, £23,302 10s. 11½d.; Geological survey (Great Britain and Ireland), £5,152; Meteorological observations at sea, £2,837 0s. 3d.; Royal Dublin Society, £7,000.

The Geological Society states "that no sum of money whatever has been granted to that Society."

The Society of Arts returns that "the Society for the Encouragement of Arts, Manufactures, and Commerce, has been established upwards of one hundred years, and has never during that period received any grant of public money whatever, and therefore none during the period named in the order of the House of Lords."

The Entomological Society states that "the Entomological Society never yet received any grant of public money."

The Zoological Society, in reply, states "that no grants have been made to the Zoological Society by her Majesty's Government at any time; but that, on the contrary, the Zoological Society will have paid to her Majesty's Government, within the five years specified in the order, the large sum of £2,117 7s. 6d., for rent of 26½ acres of land in the Regent's-park, viz.:—1852, £337 13s. 1d.; 1853, £337 13s. 1d.; 1854, £337 13s. 1d.; 1855, £398 12s. 5d.; 1856, £368 2s. 9d."

THE LIBRARY AND MUSEUM, STOKE-UPON-TRENT.

At a meeting of the committee appointed to promote the erection of public baths for the town of Stoke-upon-Trent, held on Thursday, the 8th May last, the Chief Bailiff in the chair, the following resolution was carried unanimously:—"That, in the opinion of this meeting, the eminent services rendered by Herbert Minton, Esq., as a manufacturer, to improve the productions and increase the trade and reputation of the Staffordshire potteries; and the munificent support he has given, during a long series of years, to public objects and institutions of a benevolent kind, both local and national, entitle him to be regarded as a public benefactor; that his recent liberal offer of the sum of five hundred pounds towards the erection of public baths in this town affords a desirable opportunity for giving public expression to the regard generally entertained throughout the country for his public and private character; that this meeting feels assured that the form of testimonial that would be most acceptable and valued by Mr. Minton would be such as would tend to the promotion of objects of public utility, in which he is known to take a deep interest. It is therefore resolved that a separate fund be opened for the erection of a public building of good architectural pretensions, on a site adjoining the proposed baths, in which accommodation shall be provided for a museum to illustrate the art of pottery and its history, ancient and modern; for a free library for all classes; with a studio and appliances to promote art education; such public building to be considered as a testimonial of the public approbation to Mr. Minton, and that his name shall be associated therewith in perpetuity."

Home Correspondence.

THE NEW LIST OF LECTURERS.

Sir,—Permit me, through your columns, to comment upon one of the subjects mentioned at the recent Conference held by the Society of Arts with the Institutions in Union. I allude to a matter connected with the "List of Lecturers" just issued.

For several years the Honorary Secretary to a Literary and Scientific Institution; many times a member of working committees; and, having for the last six years devoted a large portion of my time to professional lecturing, I am well acquainted with the difficulties which Mechanics' Institutions experience about lecturers and and lecturing.

I think, with Dr. Booth, that the Society of Arts, in publishing the Directory of Lecturers just issued, has done all that it can be expected to do.. The Society has given to Institutions a great deal of most useful information about the names, addresses, subjects, and terms of both professional and amateur lecturers throughout England, and beyond this it can do nothing.

The embarrassments felt by committees of Literary and Mechanics' Institutions on this subject appear to me to be the result of their own supineness. An evident inclination exists among them to *shirk the trouble* of inquiring for themselves into the suitability and capability of particular lecturers, and to throw the whole onus upon the shoulders of the Council of the Society of Arts.

The Representative from the Yorkshire Union of Institutes, at the instance, I presume, of his Committee, suggested that the Society of Arts should engage and pay certain lecturers, and send them about the country to the Institutions in Union. But this is out of the question. It would be impracticable for a Council, sitting in London, to arrange satisfactorily, as regards the lecture-night, the hour of lecture, the terms, the subject, and so on, for every one of the one hundred and thirty Institutes which are comprised in the Yorkshire Union alone! However nicely adjusted, the whole scheme would be upset by the Institutions themselves. And thus it would be done. The Society of Arts would write to the Institutions, stating that a certain lecturer on a particular subject had been engaged, and would visit all the towns in rotation. Well, one Institution would immediately write up to decline to have him, because "This subject is too dry;" or, "We have had it before;" or, "The terms are twice as much as we can afford;" or, "The night you name won't suit us; our lecture night is such a night, and we can't alter it," or "we *won't* alter it,"—for too often alas! jealousy steps in among Mechanics' Institutions, and where two neighbouring towns have fixed upon the same evening as their lecture night, neither will give way to oblige the other. Then, again, as the only room fit for a lecture in a small town is, generally speaking, the Town-hall, the arrangements may at any moment be disturbed by the Town-hall being required on the evening set apart by some more influential body than the Institution of mechanics; or, perhaps, at the head hotel, a meeting to debate some all-absorbing question of local interest may be advertised for the same evening, in which case the lecture must be "put off," as the town cannot be in two places at once. Then, the lecturers that "go down" at one town will not "go down" at another; hence, as one of the Representatives at the Conference observed, a diversity of opinion exists among Institutions as to the merits of lecturers. Some say of a particular gentleman that he is THE lecturer of the day, others, that he is "used up." At Easy-town, for instance, where there is but little of the *bustle* of business, where quietness reigns, and jog-trot habits are never hurried into a canter from year's end to year's end; where, churches, chapels, and meeting-houses, being plentiful, show that all events there is a great profession of religion in the place; where order (except on solitary occasions, when the town makes a point of getting intoxicated, to fit itself for the duty of returning a member to Parliament) is the one great rule of life; in such a town, where everything moves along with greased wheels, a quiet lecture on science or art will always be respectfully listened to and appreciated. And why? Because, being an easy-going town, at eight o'clock at night the inhabitants are not too fatigued to listen and to learn.

But at Bustle-town this sort of thing would be thought *dreadfully slow;* there all is vitality, and harrass, and over-crowding, and over-reaching, from early in the morning till late at night. Men's minds and bodies are torn and worn, and worried, and tired out, by their several occupations; *and they won't leave their homes after business is over to listen to lectures, however excellent, on dry science, or the intricacies of ornamental art.* Their minds are already over-taxed, and they are neither able nor willing to begin reasoning and arguing, and splitting straws to arrive at profound results. If they go to a lecture, it must be a lecture to soothe or amuse them. The Society of Arts, therefore, in sending a lecturer to take in Easy-town and Bustle-town, which are faithful types of most towns, would inevitably please the one, and displease the other. It had need to be made acquainted with all the inclinations and prejudices of all the towns in the United Kingdom, to be enabled satisfactorily to cater for them. We have Quaker towns, Roman Catholic towns, Unitarian towns, Independent towns, Puseyite towns, Wesleyan towns, High Church, and Low Church towns, Total Abstinence towns, Peace towns and War towns; and especial care ought to be taken to avoid wounding the prejudices of any class of persons in any of these towns. Now, how could the Society of Arts guarantee this? It would, as I have said, be utterly impossible. Dr. Booth seemed to indicate that if the *whole* of the Institutes in Union were to agree to place the matter under the control of the Society of Arts, that then something might be done. But, in the first place, the Institutions *never will* agree to this, and even if they did, for the reasons stated above, the scheme would undoubtedly fail.

The lecturers themselves have tried to assist Institutions, in arranging their lecture courses. Engagements being made to visit certain localities, proposals are sent to the neighbouring Institutions, requesting them to join in, so that the lecturer, by increasing his engagements may lower his terms. Of course this would be a mutual benefit. But how do the Institutions meet it? Too frequently by not even condescending to reply.

My object in writing has been to show the Institutions that neither the Society of Arts nor the lecturers can help them, and that the remedy for the evil of which they complain is in their own hands. They must be self-dependent; they must bestir themselves, and not only correspond with the Society of Arts, but with one another. Let the Societies in each county but unite together, and the result must be beneficial. Of course, if a lecturer is offered five or six consecutive engagements at Institutions within a short distance of each other, the cost to each Society is very moderate. This is perfectly well known, and it is a matter of the utmost surprise to me that it is not acted upon. Why should Institutions pay from four to five guineas for a lecture which, by taking a little extra trouble, they might get for £3 3s., and in the case of very poor Societies, for even less?

I have to apologise for the length of this letter,

And remain, Sir, your obedient servant,

WALTER ROWTON.

REMARKS ON MR. HAWES'S THEORY OF SAPONIFICATION.

Sir,—Mr. Anderson, F.C.S., intending to give a blow to Mr. Hawes, has, in his letter of the 20th June, *struck himself*, and has exerted infinite pains (no doubt most unintentionally) to establish the position Mr. Hawes aims at, as to the quantity of glycerine generally found or formed during the saponification of fatty matters; for Mr. Anderson quotes Vol. V. of the *Chemical Journal*, which states that 5·32 parts of glycerine were found when 100 grains of stearine were operated upon. How is this possible; since all the glycerine in the crude or raw tallow must have been removed before the stearine could be obtained? unless the 5·32 was produced by the action of heat, alkali, and water upon the stearine. If so, then glycerine is a generated, created, or artificial result, arising from some new chemical combinations or atomic changes in the distribution or arrangement of the several molecules of carbon, hydrogen, and oxygen, forming C^6, H^8, O^6, instead of stearine C^{76}, H^{70}, O^8. Then it will follow that the 5 per cent. obtained from stearine, and 5 per cent. said to exist in the raw fat or tallow, will give us 10 per cent., the amount stated by Mr. Hawes, and confirmed by Mr. Wilson. It is impossible to admit the glycerine as an element in stearine, whatever we may infer as to tallow.

I think Mr. Anderson might have been less ample and severe in his comments, particularly when his criticisms are directed against a gentleman already accused of being one of a very trifling *minority*, if not the only individual in the Society of Arts labouring under error in respect to the subject. Mr. Anderson may or may not consider himself called upon to defend the science and dignity of M. Chevreul, whose dictum he presumes, or assumes to be, covertly or directly attacked in the paper read by Mr. Hawes. I deplore my inability to be able to discover any such sinister intention towards the illustrious French chemist elicited by the paper in question. The castigation falls self-inflicted upon the proper blunderer, for M. Chevreul never stated that glycerine is an element or natural component of fatty substances, *but directly the contrary*. Chevreul states that glycerine was discovered by Scheele (not by himself, as stated). In his great work, published in 1813, he says:—"Il démontra que les matières grasses connais sous les noms d'huiles, beurres, graisses, suifs, étaient formées, à part un très petit nombre d'exceptions, par un mélange de principes immédiats, qu'il décrivit sous les noms de stearine, de margarine, d'oleine, de butyrine, de caproine et de phoéenine; que ces *principes immédiats se dedoublaient sous l'influence des alkalis, en principe doux des huiles ou glycerine* et en acides gras particuliers; qu'ainsi la stéarine produsait de la glycérine et de l'acide stéarique, l'oleine de la glycerine et de l'acide oléaque, &c."

If this extract does not hermetically close this controversy, I should infer that Mr. Anderson will be advised by his friends to supplicate the aid of her Majesty's Inspector of Schools,—him of lunar celebrity.

As to the error imputed to Mr. Hawes relative to his statement of the quantity of tallow required to produce a ton of soap, it is worthy only of a place in the pages of *Punch*; for it is well-known that tallow and town fat vary considerably in their proportion of stearine and oleine, in their animal membrane, their free water, &c. Now, it does not require years of experimental labour to know that the stearine will require one dose of caustic alkali, and oleine another; and that these chemical equivalents will govern the dose or equivalent of water to produce a good solid soap; and that the dose of water will determine the character of the soap both qualitatively and quantitively. Every soap-boiler differs somewhat in his manipulations from others of the trade; each treats his goods according to his experience, knowledge, and judgment. Some, if not all, make a mis-fit, which has to be reboiled and manipulated, or to be sold at a less price than goods properly fitted; this proves that the trade have no chemical or practical certainty as to either quantity or quality. The irregularity in the quality of the raw or crude alkalis alone opposes a formidable barrier to exact results. If the years of chemical experiment and years of practical exertions have enabled Mr. Anderson to obtain fixed results as to weight and quality, I can say safely that he is the only man, not only in the British trade, but over the whole world, that has obtained a similar success.

Mr. Anderson, in his letter of the 20th June, says:—"One more experiment more recently performed, *with the greatest attention to accuracy*, in which palm-oil was employed, gave the following results: 14,000 grains of oil gave 13,312 grains of fatty acid, which, calculated for 100 parts gives—

Fatty acids...............	94·38	100·00
Glycerine	5·62	

The ley contained in these cases, in addition to the glycerine, an inconsiderable amount of *gelatinous* matters, always the case when crude fatty matters are saponified, and which, of course, is included in the above 5·62, and, therefore, reduces the per cent. amount of glycerine still less."

Now, does Mr. Anderson, *after the greatest attention to accuracy*, wish to inform us that the palm-oil nut *contains gelatine*, a substance hitherto supposed to be confined to animal productions. When a gentleman exercises such severe criticism and animadversion upon the well-meant labours of another, it is but fair to expect he will at least abstain from the very errors he accuses and deprecates.

Mr. Anderson further states, "That after perfect saponification and decomposition of the soap by stronger acids, on renewed saponification, no more glycerine is obtainable from these fatty acids." But further on he remarks:—"The experiments of Mr. Duffy have shown that glycerine is eliminated under far more improbable circumstances, namely, by acting upon stearine with a solution made by adding alcohol to sodium." He quotes the *Quarterly Chemical Journal* in proof that the *purest stearine* furnished by saponification, 95·59 of fat acid;—does Mr. Anderson mean that the residue 4·41 grains is glycerine? He cannot, as a soap manufacturer, mean that 100 parts of stearine converted into soap yielded 95·59 fat acid, because his soap, being a constant quantity, would contain 6·50 soda and 31·00 water. Now, if this representation is correct, *the purest stearine*, saponified, will give 4·41 glycerine. As a member of the Chemical Society, and a practical chemist, as well as practical soap-boiler, he will perhaps tell us how the glycerine so obtained escaped removal when the crude oil or fat was operated upon to obtain the *purest stearine*,—or whether it ought to be attributed to the action of the alkali, caloric, water, &c., employed in the saponification? If so, Mr. Hawes is correct in his view of the matter, even by Mr. Anderson's own showing.

I believe that it is impossible to subject fatty matter, whether of the animal or vegetable kingdoms, to the action of alkali, water, and caloric, without producing glycerine; and that the longer the goods are exposed to the action of any degree of heat above 200° Fahr., in combinations of soda, potassa, &c., and water, the greater will be the amount of molecular decomposition, and the formation of glycerine.

There are yet many other points in Mr. Anderson's paper that could be refuted, especially his assertion that, "The amount of soap produced from fatty matters by saponification, irrespective of time or treatment, is unvarying and constant; and that the constitution and quantity of the soap itself, from corresponding fatty materials, never varies." I appeal to the whole trade, and to his own books, if he will permit the examination, and I feel satisfied that it is impossible, in the present state of science, to obtain uniform results. This evidence would most palpably contradict the accuracy of the latter part of Mr. Anderson's representations.

As Mr. Anderson coincides with Mr. Hawes in opinion that the production and manipulation of soap is of the greatest importance to the trade and to the public in general, you will, I trust, pardon my inundating you with proofs that the majority of opinions elicited by the leading members of the Society of Arts on that subject are incorrect, thereby confirming the trade and practical men in the ignorant destruction of valuable matter, retarding the progress of sound improvement, and tending to establish the existing rule-of-thumb system. Mr. Anderson attacks with much acrimony the opinions developed by Mr. Hawes in the paper read to your Society on the 28th of March, and accuses him "of aiming at nothing more or less than attempting the annihilation of the theory of M. Chevreul and his followers."

M. Chevreul, in his work upon the Corps Gras, writes, "Les bases, et particulièrement la potasse, la soude, et la chaux, décomposent le stéarine, en présence de l'eau et à l'aide d'une ébullition prolongée. Cette réaction, connue sous le nom de *saponification*, produit de la glycerine hydratée et un stéarate alcalin: le poids de l'acide stéarique libre, après son alimentation du savon par son acide, ajouté à celui de la glycerine, surpasse d'une proportion notable le poids de l'alcali hydraté. Mons. Chevreul s'est assuré que cette augmentation de poids se manifeste dans la saponification de toutes les matières grasses neutres. Ainsi, 100 parties de stéarine donnent 102.6 d'un mélange qui contient 94·6 d'acide stéarique, et 8 parties de glycerine. L'augmentation de poids est due à la fixation des éléments de l'eau."

The free translation of which is as follows:—"The bases, and particularly potassa, soda, and lime, decompose stearine in the presence of and by the aid of water in a prolonged state of ebullition; that reaction, known under the name of saponification, *produces hydrated glycerine*, and a stearated alkali. The weight of the free stearic acid, after its elimination from the soap by an acid, added to that of the glycerine, surpasses in a notable proportion the weight of the fatty matter submitted to the action of the hydrated alkali. M. Chevreul has assured himself that this augmentation of weight manifests itself during the saponification of every neutral fatty matter. Thus: 100 parts of stearine gives 102·6 parts of a compound which contains 94·6 stearic acid, and 8 parts of glycerine. The augmentation of weight is due to the fixation of water."

I, some four years since, endeavoured to convince Mr. George Wilson, F.R.S., of his error relating to the formation of glycerine. He understands the French language, and said he possessed the works of Chevreul, Pelouse, Regnault, &c., yet, in 1856, he bears his testimony and supports opinions upon this important subject, involving a sacrifice of above £150,000 per annum in England only; and it is with pain I see him join with Mr. Anderson, F.C.S., and Mr. Dugald Campbell, Mr. De la Rue, F.R.S, and others, in condemning Mr. Hawes for announcing facts established by M. Chevreul as long back as 1818. These gentlemen stigmatise Mr. Hawes as a perverter and destroyer of the beautiful truths proclaimed by the illustrious French chemist. The absurdity of such conduct will be evident to all who will read the extract I have made.

I am, &c.,
H. C. JENNINGS.

8, Great Tower-street, 28th June, 1856.

RELATION BETWEEN DECIMAL COINS AND WEIGHTS AND MEASURES.

7, Finsbury-circus, June 28th, 1856.

SIR,—The serious objections which exist against the adaptation of decimal coins to our currency again must be pleaded as a reason for my addressing the *Journal* to point out the practical manner by which they may be probably introduced with least injury, and be rendered sufficiently attractive for the mass of the people to desire their adoption.

In my last letter, I recommended for practical use the additional issue of the $\frac{1}{10}$ of a florin and the $\frac{1}{100}$ of a florin, with the super-addition, for adjustment, of little coins of the value of the $\frac{1}{6}$ of the $\frac{1}{100}$ of a florin, the $\frac{1}{12}$ and the $\frac{1}{24}$ of the same to be called respectively, mites, half-mites, and quarter-mites.

Without unnecessarily occupying space in your *Journal* with abstract views on this question, which I have fully considered in my "Sources of Physical Science," I have here to propose that the new coins be brought into relation with our weights and measures, so that tens of centuries hence, upon the discovery of the coins a near approximation may be obtained of the standards of value, length, weight, and capacity used in our towns.

The decat, or $\frac{1}{10}$ of a florin might represent also the $\frac{1}{10}$ of a lb. avoirdupois, the $\frac{1}{10}$ of a foot, the $\frac{1}{10}$ of the $\frac{1}{10}$ of the weight of an imperial gallon of water, and the $\frac{1}{10}$ of the $\frac{1}{10}$ of the bulk of an imperial pint.

To accomplish this object the decat must weigh 700 grains, be the $\frac{1}{10}$ of a foot in diameter, and the metal must either have a sp. g. of 8·75, or, if of copper, have its rim raised to compensate the excess of sp. g., which is from 8·8 to 8·9.

The mil might represent the $\frac{1}{10}$ of the $\frac{1}{100}$ of a lb. avoirdupois, and be half-inch diameter.

The mite should weigh 10gr., the half-mite 6gr., and the quarter-mite 1gr., which would be useful weights for chemists and other dealers in small quantities of matter, and thus coins would be brought into relation with apothecaries and troy weights.

As this letter is merely suggestive, I do not think it necessary to enter minutely into all the practical results which would be obtained by the above system. It is manifest, however, that it would give a basis of a decimal division of value, weight, length, and bulk, and at the same time effect a material relation between the decimal division and the other modes of division now in use.

If the principle be adopted, the nomenclature would have to be carefully reconsidered; and it appears to me, whether we consider value, bulk, surface, weight, or capacity, from five to ten of the decimal divisions shall have definite words assigned to them. At first we shall have both systems in operation at once, but, by degrees, hereafter all divisions not found to be practically convenient might be gradually withdrawn.—I am, &c.,

ALFRED SMEE.

CORT'S CLAIMS.

Sir,—A financial writer has contemplated the possibility in distant ages of natives of New Zealand and other Australian empires, sailing northward to view the ruins of London-bridge. Unless printing be then antiquated by some other art, this posterity may read in their Gazeteers and Topographical dictionaries, such passages as the following:—

"Great Britain.—An active ancient nation, in the northern hemisphere, which, in its day, made a considerable figure in the world. In the 19th century, it was greatly distinguished by its success in useful arts and manufactures, especially in the making of iron, and by a peculiar method of forming iron roads, which, by all remaining accounts, were a vast improvement on the previous imperfect means of moving men and goods from place to place. The natives appear, however, to have been a dull and apathetic people, very fond of their money. Some time after the middle of this century, it was discovered that the process for making the iron for these roads had been perfected about 70 years before, by one man, who was called an inventor, that his children were living in neglected poverty, and that the manufacturers of iron, who had realised 30 millions sterling of profits (here will follow a reduction of this sum to New Zealand currency), subscribed for the relief of his distressed widow a sum amounting to less than one thirty-thousandth part of their gains. The discovery appears to have attracted some attention. That 70 years should have passed in such ignorance seems strange, because there appears to have been a great deal of printing in those days, about useful arts and inventions. But from the specimens which have been preserved of those "newspapers," it appears to have been much the habit to write on a limited series of subjects which were repeated over and over again with an extraordinary perseverance. It must have been this pre-occupation of mind, which prevented attention to common things, even of the most extraordinary character, immediately before their writers. Some eccentric individuals, however, seem to have exerted themselves considerably, to remove from the national honour the stain of ingratitude and stupidity, and to obtain from their national assembly, which had the habit of granting large sums of public money for many curious purposes, a creditable reward and recompense to the 'inventor's' family for so many years of neglect."

Some ill-natured writer, in those future times, might indulge his pen in harsher remarks. It is painful to know that such a history of ingratitude is too true. "Great Britain, the nation which did not even thank the man who saved her 500 millions sterling in seventy years, and raised her to the highest pitch of prosperity," will look better, when it can be added, "however, in the 71st year she repented and made amends." If you can find room for the following petition, it will exhibit that there are men in the kingdom able and willing to wipe out the national disgrace and place us in a decent position with worlds to come.

Mr. Roebuck's overwhelming engagements have hitherto delayed the presentation of this petition, and of another from Mr. R. Cort, declaring the enormous benefits derived from his father's inventions. The honourable member, however, will present both petitions immediately, and no doubt will do all he can to get them printed and distributed, that both Houses of Parliament may be made acquainted with important facts, which appear at present to be known to only a very few of them.

DAVID MUSHET.

July 2nd, 1856.

PETITION.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland, in Parliament assembled.

The petition of the undersigned manufacturers, consumers, and others, who feel that the nation has greatly benefitted by the use of British puddled and rolled wrought iron, first invented and successfully established in all the royal dockyards by the late Mr. Henry Cort, of Gosport, in the county of Southampton, iron manufacturer; for the safety of our fleets and seamen; for our naval and military defence at home and abroad; for railways, steam navigation, ship building, agriculture, mining, domestic, and other purposes; and, lastly, for securing the independence of the British nation over foreign powers, for an adequate supply of bar iron.

Showeth,

That previous to 1782 the whole population of Great Britain was every year becoming more and more dependent on foreign powers for an adequate supply of bar iron, the total make of pig iron with charcoal fuel being only 17,350 tons, while the export, according to a return from the Custom-house, in 1812, did not exceed 427 tons.

That in 1783 and 1784 two patents were granted to the late Mr. Henry Cort; one for rendering pig iron and other cast metal malleable in an air furnace heated by the flame of pit coal, without the aid of charcoal, or blast of bellows, or cylinders, termed puddling; and the other for rolling the iron into bars, or other forms, at a welding heat, through grooved rollers, never before used, and ever since universally adopted.

That from 1785 to 1854 the make of puddled and rolled iron has continued more and more to supersede the use of foreign iron, except for fine steel. The total quantity of iron made with pit coal in 1854, by the last return from all the iron works, was 3,585,906 tons, from which the total quantity of puddled and rolled iron may be estimated at not less than two millions of tons; while the total quantity of the latter exported on the average of three years ending 5th January, 1855, from a return made to your Honourable House, was 856,738 tons.

That as the iron trade of Great Britain, at a general meeting in 1811, unanimously acknowledged that it was greatly indebted to the late Mr. Henry Cort for these unexampled improvements in the iron industry of the country, whereby enormous sums of money have been less paid to foreign countries for bar iron, and more received from them for British puddled and rolled iron, while the wants of the whole population have been supplied out of materials previously useless, and by the labour of millions of the people, at a saving of more than 200 per cent., compared with the price of foreign iron in 1782.

Your petitioners humbly pray that your Honourable House may be induced to make some adequate provision for the declining years of the only surviving representatives of the late Mr. Henry Cort, being one son and three daughters, only one of whom is under seventy years of age, for having added, by the inventions of their father, at the expense of ruin to himself and family, so enormously to the wealth of the country, year after year, for more than half a century, besides extending its commerce in British iron to all the markets of the world.

And your petitions as in duty bound will every pray, &c., &c.

(Signed)

Anthony Hill, Iron Master, Plymouth Works, Glamorganshire.
Robert Stephenson, M.P., F.R.S., President of the Institution of Civil Engineers.
Crawshay Bailey, M.P., Iron Master, Aberaman Works, Glamorgan.
John Heathcoat, M.P.
Edward John Hutchins, M.P., Chairman of the Rhymney Iron Company.

William James Chaplin, M.P., late Chairman of the South Western Railway.
George Hadfield, M.P.
George Bowyer, M.P.
Sir William Cubitt.
James Simpson, C.E.
Joshua Field, C.E., F.R.S.
James Meadows Rendel, C.E.
Late Presidents of the Institution of Civil Engineers.
George Bidder, C.E., Vice-President of the Institution of Civil Engineers.
Charles Manby, C.E., F.R.S.
Sir Charles Fox.
William Cubitt, M.P.
Wm. E. Boyes, Iron Manufacturer, Swindon-house.
Sanderson Brothers and Co.
Thomas Turton and Son.
Henry E. Hoole.
Charles Sanderson.
Jessop and Son.
Naylor, Vickers, and Co.
Stewart and Smith.
Dixon and Sons.
Marsh Brothers and Co.
Joseph Rodgers and Son.
William J. Horn and Co.
Manufacturers, Sheffield.
John Scott Russell, C.E., F.R.S.
Charles Hood, F.R.S., Iron Merchant.
William B. Carpenter, M.D., F.R.S.
James Booth, LL.D., F.R.S., Chairman of the Council of the Society of Arts.
Edward Solly, F.R.S.
Robert Hunt, F.R.S.
Thomas Bennet Lawes, F.R.S.
Thomas Webster, M.A., F.R.S.
George Rennie, C.E., F.R.S.
Thomas Henry Maudslay, C.E.
David Mushet.
Thomas Page, C.E.
Alexander Gordon, C.E.
Evan Hopkins, F.G.S., C.E.
Joseph Cubitt, C.E.
D. T. Evans, Barrister, Author of Letters on the Iron Industry of South Wales.
Macnaught, Thomas, Robertson, and Co., Iron Merchants.
Thomas M. Paine, R.A.S., Surrey.
John Thomas Way, R.A.S.
Edward Rae, Wilsden-house, Wilsden.
John Fowler, C.E.
Boyd and Chapman, 78, Welbeck-street.
James S. Wickens, 35, Mortimer-st., Cavendish-sq.
R. Middleton, Mining Journal.
William Burton, 39, Oxford-street.
Thomas Brettell, 35, Rupert-street.
John Leslie, 59 and 60, Conduit-street.
&c. &c. &c.

Proceedings of Institutions.

◆

Boston Athenæum.—On Tuesday the 17th of June, was inaugurated the new building, erected on the site of the old Green Dragon-inn, Market-place, and forthwith to be occupied by the members of the Boston Athenæum, for the purpose of a Literary and Scientific Institution. The building has been erected by the directors of the Corn-exchange Company, the Athenæum members being the tenants. The front façade of the Athenæum is in the modern Italian style of architecture, executed entirely in the fine material of the Ancaster quarries, and consists of three stories, each having its individual character. The apartments of the Athenæum comprise the upper part of the building, and consist of a reading room, occupying the whole of the front, 35ft. 6in., by 26ft. 6in., and 17ft. high. The library occupies the back, and is 30ft. by 16ft.; a librarian's room is attached. Over the reading-room is a large room suitable for lectures, readings, and other purposes, with rooms for classes, &c., attached. The ground and basement stories are appropriated to a shop and warehouse, with living rooms attached. The building has been executed from the designs and under the superintendence of Messrs. Bellamy and Hardy, architects, of Lincoln, and the clerk of works, Mr. John Saville, who has carried out faithfully their designs. A *dejeuner*, to celebrate the opening, took place at the Assembly-room at three o'clock, and was attended by a large and highly respectable company, including many of the gentry and clergy of the town and neighbourhood. The chair was occupied by the Mayor (F. Cooke, Esq.); the President of the Athenæum (Thomas Garfit, Esq.) and Alderman Noble acted as vice-chairman.—The Mayor in proposing the first toast—the "Health of the Queen," after describing the advantages derivable from Literary and Scientific Institutions, and the good that must result from the extension of education, spoke of the aid the Queen was ever ready to offer to societies established for the promotion of art and science, and said her Majesty entitled herself to the love of her subjects as much by regard for Institutions of an elevating and philanthropic character as she did by the maintenance of those strictly constitutional principles which had so pleasingly marked her reign. In introducing the next toast—"Prince Albert, the Prince of Wales, and the rest of the Royal Family," the Mayor said every one knew the Prince Consort's devotion to the arts and sciences, and the interest he took in establishing Institutions similar in character to that they were now celebrating. As for the Prince of Wales, his education was such that they might fairly augur much from him.—Mr. White proposed the "Army and Navy." —Mr. Jebb returned thanks. He was ready to respond to the call, though he scarcely knew why he should have been named to return thanks for the toast, unless it was because he had three sons in the military service. He felt he was placed in a position of some difficulty, though he was relieved in a great measure by the address of Mr. White, who had done ample justice to the merits of the army; and he need only add his assurance that the honour and safety of this county might be safely reposed in the army and navy. The late war had shown the estimable qualities of both services. He could not refrain from repeating an observation made by General Williams on his landing at Dover on Saturday last, as it was one which could not be too carefully stored up. The Corporation of Dover, anxious to do honour to a soldier of so much renown, presented the General with an address, and in the course of his reply, General Williams said, "Woe to the nation that forgets the military art! Woe to that nation who heaps up riches, but who does not take the precaution to defend them!" Before he concluded, Mr. Jebb alluded to the occasion on which they had met, and augured well of the prosperity of the Athenæum by seeing the entertainment graced by the presence of so many ladies, and countenanced by so many gentlemen from the neighbourhood. He thought the Institution might be made serviceable to the country people, who could avail themselves of the market-day attendance to procure books.—The Mayor announced that Mr. Cabbell, M.P., though unable to attend, had testified the interest he took in their proceedings by making a donation of 10 guineas towards the funds of the Athenæum.—Mr. W. Garfit then proposed, "The Clergy and Ministers of Religion," which was responded to by The Rev. G. B. Blenkin (the Vicar), who was warmly received. He said he was grateful for the opportunity thus afforded him of testifying the sincere interest he felt in Athenæums in general, and in that of Boston in particular. It had been frequently charged against the clergy of the church that they did not manifest any interest in promoting science and the arts, because it seemed to have been thought that science and religion were in antagonism, and that faith and reason could not satisfy their respective claims. There might have been times when such charges were true, but they were in the dark ages. In Galileo's time, they all knew, science did experience trials and dangers; but since the blessed light of the Reformation had dawned on the world, and the glorious liberty of Protestantism had shed its benign influence on nations, the charge had ceased to be any longer true. When science was made, as she ought ever to be, the handmaid and not the mistress of religion—when reason subjugated herself and bowed at the feet of the cross, and talent consecrated its pen to Him by whom talent was given—then the ministers of religion could candidly go onward and hold out the right hand of fellowship to those who desired to promote the arts and extend the mental capacity of man. He held in his hand a letter from a gentleman who had done more for science than any other living man—Adam Sedgwick—one who had indeed, by his inquiries, found sermons in stones, and illustrated and proved from geology the truth of God's holy word. In that letter he expressed his sincere regret that, owing to a long illness, and being in residence as a Canon of Norwich, he was not able to be present at the opening of the new building for the Athenæum. The Vicar concluded by expressing his earnest hope that the Boston Athenæum would prove a handmaid to religion, and make its members not only more cultivated in intellect, but better Christians, better citizens, and better men.—Sir CHAS. ANDERSON next rose and proposed, "Success to the Boston Athenæum." He assured the company their object in promoting the interests of the Athenæum had his entire sympathy, because he felt convinced that, if such Institutions were properly conducted, they must tend very much to benefit society at large. What was wanted was judicious education of the people; and in proportion as that education was extended would the moral and social condition of the people be improved. There were three points connected with education which it was necessary should be borne in mind—the intellectual, the moral, and the practical education which was useful in every man. The intellectual and the moral, without the practical, would be of very little use. Practical education—that which enabled a man to fulfil his duties in the station he occupied—was the education most wanted in this country. This was a subject, however, on which he need not now enlarge. He would simply observe that it was desirable that practical education should be diffused, the effect of which would be to make better citizens and better men.—The PRESIDENT of the ATHENÆUM (Mr. Thos. Garfit) in responding to the toast, said there could be no doubt that Institutions of this kind, although of recent growth, had attained considerable importance, and exercised great influence throughout the country. They had not only been joined by large numbers of those classes for whose benefit they were intended, but they had received the countenance and support of many of the ablest, wisest, and best men of the age. They had received the sanction of the Legislature, and also of many large and important Societies, among whom perhaps stood foremost the Society of Arts. He (Mr. Garfit) well remembered hearing Lord Granville say, at an important gathering at the Crystal Palace, over which the Duke of Argyll presided, that the Society of Arts, and the kindred Societies in Union with it, might be looked upon as the Zouaves of literary institutions, as, like those bold troopers, through whose daring, zeal, and impetuosity a path was opened for more regular and systematic operations, they paved the way for the establishment of associations whose object was the spread of knowledge, and so acted as the pioneers of general education. The utility of any particular institution depended on the amount of support it received, and the manner in which it was managed, and he felt bound to say that the management of the Boston Society reflected considerable credit on the members, and had been of considerable advantage to the public.—Mr. W. H. Adams then proposed, "The Society of Arts, Manufactures, and Commerce, and the Institutions in Union with it." It was, he said, a toast that in itself carried such strong recommendations, that to entitle it to a proper reception he need scarcely do more than read it as it was set down in the paper; indeed, it might be thought an act of presumption on his part if he attempted to enlarge on it. Still he could not refrain from expressing the warm approbation he felt for the Society of Arts, which had done so much to extend a love for education, and by its fostering care to bring other Societies into vigorous and useful exercise. The Society of Arts had pursused a course exactly the opposite of that which marked the proceedings of the men of power in the days of Galileo. Then the possessors of knowledge, feeling the power it gave them, endeavoured to keep that power within their own hands. The Society of Arts, feeling also that it had the power which knowledge confers, was anxious to extend that power, and one of its acts was found to be to lend its aid to other Institutions having for their object the spread of enlightenment and scientific discovery—to extend a knowledge, amongst other things, of that very science in the cause of which Galileo became a martyr. The Society of Arts was not desirous of retaining within its own hands the privileges which it had acquired, but had scattered them in widespread streams through the country, and was glad to hail as belonging to themselves the many Societies now affiliated with them. There was a time when it became necessary to enact penal laws against societies that had their heads in London and branches in the country; but the knowledge spread by those Corresponding Societies was used to overthrow "the powers that be." They lived in happier times than those. They lived in times when intelligence had been diffused so extensively that it was no longer necessary to confine political power to its former limits, for the masses of the people were becoming better fitted to deal with public questions, and to exercise political privileges with integrity and discretion. In one respect the Society of Arts might be said to resemble the old Corresponding Society. In those days that Society sought to overthrow an empire—an empire which was established in the hearts of millions, and which he hoped would endure for many generations. The Society of Arts also sought to overthrow an empire—but that was the empire of ignorance; and happy would they all be if they could see that empire utterly and entirely overthrown, never again to rise. It was gratifying to him (Mr. Adams) and to a few others than present, to witness the proportions into which the old Institute had expanded. He believed there were only six, who presided at its birth, now remaining, and some of them had grown gray in the cause of public education. The old Institute must be considered as the germ of the Athenæum, and they who assisted at the birth could not fail to rejoice now that it had attained its present maturity. He had only to express a hope that other kindred institutions might be able to obtain an equally good building; and the best wish he could utter was that throughout the length and breadth of the land every town and village and hamlet might have its society to bring instruction to every man's door, so that if he remained ignorant, his ignorance might be his own fault and the blame on his own head.—Mr. H. GORE returned thanks. He gave a sketch of the objects of the Society, its operations, and the great assistance it rendered to Institutions in Union with it.—The Rev. J. WILSON, of Wigtoft, proposed "the Mayor and Corporation of Boston;" and the Mayor returnen thanks.—The Rev. H. HOLDSWORTH proposed "the Corn-Exchange Company."—ALDERMAN NOBLE said, without the gentleman who had come forward to subscribe their money to the Corn Exchange they would have been unable to obtain such a building as they had now got for the Athenæum; and the advantage would be felt to be the greater when they remembered the room they had come from. At a *Soirée* in the Assemby-rooms a few years ago, the Earl of Yarborough suggested that an appropriate building was desirable, and his lordship tendered a handsome subscription towards the object. Mr. Adams also offered a liberal sum, and other gentlemen expressed their readiness to assist, but they never could have got sufficient funds without the aid of their country friends; and when the agriculturists came forward and put their hands in their pockets, that solved the difficulty. He was glad to find they could attribute so much to those for whom they were indebted for the bread they ate, as, besides their disposition to befriend them, it showed that the land had not quite gone out of cultivation yet. It showed also that they were increasing their taste for literature, and that the inhabitants of the town and the inhabitants of the country would be likely to go hand in hand together. In returning thanks on behalf of the Corn Exchange Company, he was pleased to acknowledge that they owed a debt of gratitude to the farmers and landlords in the neighbourhood for the manner in which they came forward to assist the interests of the Institution. Mr. W. E. **Chapman** proposed the Members for the Borough.—Mr. **Mark Lemon** returned thanks on behalf of Mr. Ingram, who was prevented from attending by pressing engagements, and also by an accident which had happened to his mother. Mr. Ingram, however, expressed the deep interest he felt in the prosperity of the Athenæum, and had forwarded a cheque of ten guineas to the funds.—The *Déjeuner* was followed by a *Soirée* at the Corn Exchange, which was attended by a large number of persons, the President of the Athenæum, Mr. Garfit presiding, The following resolutions were passed:—1. "Resolved that, in the opinion of this meeting, the numerous Scientific and Literary Institutions which have been established of late years afford a very powerful aid to the best interests of all classes of society, by enlarging the field for the exercise of the intellectual faculties, by strengthening the ties of brotherhood and social feeling, by affording constant opportunities for self-improvement, and by the free and cordial communication of useful knowledge."—2. "That this Institution, in its enlarged and improved state, promises to be eminently conducive to the happiness and well-being of the inhabitants of the town and neighbourhood of Boston, and possesses just claims to confidence and support." The proposer thought an itinerant library in the neighbourhood would be a great instrument of improvement. It might be made to radiate through whole villages, and thus find its way to many hands, eyes, heads and hearts. 3. "That the best thanks of the meeting be given to Sir Charles H. J. Anderson, Bart., Dr. R. G. Latham, Henry Gore, Esq., Mark Lemon, Esq., the Rev. E. Larken, and the other distinguished visitors who have obligingly honoured the inauguration of the new Boston Athenæum with their presence."—4. "That the thanks of this meeting be given to the Worshipful the Mayor, the President, the Vice-Presidents, Committee, Honorary Secretary, and Officers of the Society, for their generous and efficient services." The proposer alluded in praiseworthy terms to the exertions, on this as well as on all occasions, of Mr. J. W. Bontoft, the honorary secretary, who spared no pains, and thought nothing too much trouble, that was likely to advance the interests of the Institution.

MEETINGS FOR THE ENSUING WEEK.

Mon. Entomological, 8.
Tues. Zoological, 9.
Wed. Literary Fund, 3.
Sat. Royal Botanic, 3¾.

To Correspondents.

Erratum.—In last No., p. 568. col 2, under head "Examinations," 1st line, for "I," read "We."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 14th and 16th June, 1856.

Par. No.
280. Waterford Post Office—Return.
204. Secretaries of State—Returns (a corrected copy).
168. Bills—Cambridge University (as amended in Committee, and on Re-commitment).
175. Bills—National Gallery (as amended by the Lords).
176. Bills—Survey of Great Britain, &c.
177. Bills—Hospitals (Dublin).
178. Bills—Seamen's Savings Banks.
Convict Discipline and Transportation (Australian Colonies)—Further Correspondence.
Sardinia—Convention.

Delivered on 17th June, 1856.

254. Prisons—Return.
268. Guns—Return.
271. East India—Home Accounts.
278. Ecclesiastical Commission, &c.—2nd Report from Committee.
282. Conveyances of Land (Ireland)—Return.

Delivered on 18th June, 1856.

163. Prisons (Separate Confinement)—Abstract of Return.
275. Naval Prize, Bounty, &c.—Account.
265. Nawab of Surat Treaty Bill—Minutes of Evidence, Parts 1 and 2.
180. Bills—Mercantile Law Amendment.
181. Bills—Mercantile Law (Scotland) Amendment.
182. Bills—Hay and Straw Trade.

Delivered on 19th June, 1856.

284. East India (Pension to the Marquis of Dalhousie)—Resolution of the Court of Directors.
286. Militia (Regiments Volunteered for Service Abroad)—Return.
287. Fisheries Board (Scotland)—Copy of a Treasury Minute.
174. Bills—Deeds (Scotland).
179. Bills—County Courts Acts Amendment.
183. Bills—Marriage Law (Scotland) Amending.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette June 27th*, 1856.]

Dated 29th March, 1856.

768. Charles Durand Gardissal, 10, Bedford-street, Strand, London—Certain improvements in machinery for sweeping streets and other ways. (A communication.)

Dated 14th May, 1856.

1140. Alphonse Meillet, 39, Rue de l'Echiquier, Paris—An improved artificial stone for grinding, sharpening, and polishing.

Dated 22nd May, 1856.

1224. Charles Barreswil, Paris—Improvements in gas meters.

Dated 10th June, 1856.

1374. Henry Wagner, Everett-street, Russell-square—Improvements in beds and mattresses, and in similar articles of bedding.
1376. William Brookes, 73, Chancery-lane—Improvements in the treatment of corn. (A communication.)
1378. Perceval Moses Parsons, Duke-street, Adelphi—Certain improvements in the permanent way of railways.
1380. Armand Eugène Preux, Paris—Warming railway and other vehicles.
1382. William Wilson, Newcastle-upon-Tyne—Improvements in machinery for pulling the hair from coney and other skins. (Partly a communication.)

Dated 11th June, 1856.

1383. Henry Benson James, Derby—Improvements in moulding metallic castings.
1384. William Henry Westwood, Thomas Wright, and Edward Wright, Queen's-cross, Dudley—An improved stop or regulating valve.
1385. William Bayliss, Birmingham—A new or improved manufacture of ornamental metallic tubes.
1387. James Combe, Belfast—Improvements in machinery for carding and roving tow, and other fibrous substances, part of which improvements is applicable for transmitting motion in other mechanism.
1388. Alfred Vincent Newton, 66, Chancery-lane—Improvements in breech-loading fire-arms. (A communication.)

Dated 12th June, 1856.

1389. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of spoons, forks, and other similar articles, and in the machinery employed therein. (A communication.)
1390. James Eives, 17, Cornhill—Improved machinery for extracting oil from oleaginous seeds. (A communication.)
1391. Philip Wesley Hardwick, Gibson-square—An improved manufacture of tickets for railway and other uses.
1392. Philip Unwin and John Unwin, 124, Rockingham-street, Sheffield—Improvements in the manufacture of pen and pocket knives.
1393. Daniel Spill, Stepney-green—Improvements in purifying spirits of tar or coal tar naphtha.
1394. James Fairclough, Liverpool—An improved expander and contractor for dining tables.

1395. John Stenhouse, 15, Upper Barnsbury-street, Islington—Improvements in the preparation of a decolourising material, suitable for the treatment of acid, alkaline, and neutral solutions.
1396. Charles John Lewsey, Albion-terrace, Commercial-road East—Improvements in sugar cane mills.
1397. George Louis Stott, St. George's, Gloucester—Improvements in purifying gas.

Dated 13*th June*, 1856.

1398. Thomas Cowburn, Manchester—Improvements in valves for reducing the pressure of steam or other liquids or fluids.
1399. William Massey, Manchester—Improvements in looms for weaving.
1400. Constant Jouffroy Duméry, Paris—Improvements in machinery to be used for manufacturing shoes and boots.
1401. William Richard Whitmore, Cambridge-terrace, Clapham-road, Surrey—Improvements in multitubular steam boilers.
1402. William Mason, Pembroke-dock, Pembroke—An improved rowlock for boats.
1403. John Le Cappelain, 42, New Bridge-street, Blackfriars—Improvements in machinery for bending sheet iron into corrugated forms for constructing beams. (A communication.)
1404. Servans De Jong, 17, New Hampstead-road—Improvements in warming and ventilating apartments and buildings.
1405. William Jacot, Molyneux-place, Water-street, Liverpool—Improvements in fire-arms. (A communication.)
1406. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Certain improvements in ship-building. (A communication.)

Dated 14*th June*, 1856.

1407. Hypolitte Mège, Paris—Improvements in the manufacture of bread.
1408. Joseph Bunnett and Joseph George Bunnett, Deptford—Improvements in the manufacture of sash-bars, columns, and mouldings, for building and decorative purposes.
1409. Jean Etienne Machard, Annecy, Piedmont—Improvements in printing or dyeing skeins, tissues, or other textile fabrics of cotton, wool, flax, and other fibrous substances. (A communication.)
1411. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Certain improvements in metallic packing for stuffing boxes and pistons. (A communication.)
1412. Etienne Auguste Aublet, Paris—Improvements in rotary engines.
1413. William Wright, Forth-street, Newcastle-on-Tyne—Improvements in the manufacture of articles of glass and plastic materials by means of pressure.
1414. William Seed, Preston—Certain improvements in "Lap machines," or apparatus used in the preparation of cotton and other fibrous substances for spinning.
1415. Edward Lindner, New York, U.S.—Improvements in breech-loading fire-arms.

Dated 16*th June*, 1856.

1416. Joseph Sutcliffe and James Leech, Rochdale—Improvements in machinery or apparatus for opening, cleaning, and preparing cotton, wool, and other fibrous substances.
1417. Charles Desnos, Bedford-street, Strand—Improvements in furnaces for consuming smoke. (A communication.)
1418. Edouard Guérin, Paris—A self-acting apparatus for working railway brakes.
1419. William Henry Barlow, Derby, and William Henry Woodhouse, Parliament-street—Improvements in connecting and securing the ends of rails of railways.
1420. James Ball Mannix, Westminster—A method of applying locomotive power to the working of inclines. (A communication.)
1421. William Turner, Tunnicliffe, George Hulme, 4, George-street, Rochdale, and Henry Blackburn, Milnrow—Improvements in condensing and other carding engines, billies and mules for carding, slubbing, and spinning woollen, cotton, or other fibrous substances.

Dated 17*th June*, 1856.

1422. John Gedge, 4, Wellington-street South, Strand—Improvements in building materials. (A communication.)
1423. John Gedge, 4, Wellington-street South, Strand—An improved pump reservoir, and apparatus for measuring liquids. (A communication.)
1424. Joseph Davis, Birmingham—A new and improved method of manufacturing the small coke, commonly called breezes, which said method of manufacture economises heat, and effects the suppression or partial suppression of smoke.
1425. Henry Holland, Birmingham—Improvements in the manufacture of umbrellas and parasols.
1426. John Sadler, Josiah Green, and Thomas Davis, Birmingham—Improvements in the manufacture of hinges.
1427. Arthur George Baylis, Redditch, Worcestershire—An improvement or improvements in needles.
1428. James Eives, 17, Cornhill, London—An improved dynamometer—(A communication.)
1429. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the treatment of sugar canes, and in the apparatus employed therein. (A communication.)
1430. Frederick Collier Bakewell, 6, Haverstock-terrace, Hampstead—Improvements in percussion bomb shells. (A communication.)
1431. William Baynton, High-street, Bilston—Improvements in rolling rails for railways.
1432. Alexandre Depai, 53, Rue de Bercy, Paris—Improvements in brakes for railways.
1433. Christopher Nickels, Albany-road, Surrey, and James Hobson, Leicester—An improvement in weaving when Jacquard or other ornamenting apparatus is employed.

Dated 18*th June*, 1856.

1434. Raymond Leopold de Berenger, Enfield—Improvements in nosebags.
1435. Thomas Burton, Padiham, near Burnley—Improvements in machinery or apparatus for sizing and dressing warps, yarns, or threads.
1436. Walter Henry Tucker, Fleet-street—Improvements in locks and latches.
1437. Matthew Andrew Muir and James McIlwham, Glasgow—Improvements in looms for weaving.
1438. Charles Clifford, Temple—Improvements in boat-lashings, and in blocks and apparatus used for raising and lowering boats and other articles.

Dated 19*th June*, 1856.

1441. George Tillett, Clapham—Improvements in bedsteads.
1443. Francis Gybbon Spilsbury, Chaudfontaine, Belgium—Making soda and alum.
1445. Theodore Schwartz, 67, Gracechurch-street—An improved brick.
1447. William Mills, 2, Lower Craven-place, Kentish-town—Improvements in pianofortes.
1449. Jacinto Dias Damazio, Lisbon—A new process of making illuminating and heating gas by a double distillation without retort. (A communication.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1439. Charles Edmond Green, 13, Blandford-street, Portman-square—Improvements in tents, huts, and camp hospitals.—19th June, 1856.
1450. William Radley, High-street, Peckham—Improvements in machinery, apparatus, materials, and processes for preparing and treating auriferous, argentiferous, and cupreous rocks, minerals, and alluviums, parts whereof are applicable to other purposes.—20th June, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed June 27*th*, 1856.

2938. George Chisholm.
2948. George Royds Birch.
2956. Archibald Turner.
22. John Henry Johnson.
28. Charles Marsden.
30. Henry Bach.
62. Henry Stuart and Thomas Pritchard.
116. John Abraham.
166. Peter Armand le Comte de Fontainemoreau.
436. David Auld and John Stephen.
481. Louis Arnier.
698. William Clay.
758. James Eives.
765. Adolphe Guido.
968. Alfred Vincent Newton.
976. William Henry Balmain and Thomas Colby.
988. Walter Neilson.
1020. John Henry Johnson.

Sealed July 1*st*, 1856.

8. Andrew Shanks.
14. Frederick Haines.
18. William Alfred Distin.
39. Joseph Betteley.
96. Alexandre Tolhausen.
123. Peter Armand le Comte de Fontainemoreau.
197. Felix Chauchard.
209. Alexander Dalgety.
216. Samuel Statham
841. Charles Durand Gardissal.
1093. John Henry Johnson.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

June 24*th*.

1581. William Charles Spooner.
1601. John Fall.

June 25*th*.

1561. Auguste Edouard Loradoux Bellford.

June 26*th*.

1569. John Imray.
1570. George Arthur Biddell.

June 27*th*.

1559. Carlo Minasi.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3850	June 19.	Improved Plough	Fowler and Fry	Bristol.
3851	„ 23.	Carlton Glove Fastening	Thos. J. Shingleton	Bermondsey.
3852	„ 27.	The Double Vest, or Two Vests in One	Jane Grace Webber	11, Charter-house-street.
3853	„ 30.	Design for an Air-tight Bread Tank Lid	Burney and Bellamy	Millwall.
3854	„ 30.	Design for an Air tight regulating delivery Spout for Iron Wheat Tank......	Burney and Bellamy	Millwall.

Journal of the Society of Arts.

FRIDAY, JULY 11, 1856.

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NOTICE TO INSTITUTIONS.

The Council have directed that a copy of the "Hand-book of Mechanics' Institutes, with Priced Catalogue of Books suitable for Libraries," by W. H. I. Traice, be presented to each Institution in Union. Copies have accordingly been this week sent by post.

EXEMPTION FROM RATING.

The Committee in the House of Commons on the Scientific and Literary Societies Bill is deferred till Monday next.

EXAMINATION OF MEMBERS OF CLASSES IN INSTITUTIONS.

We, the undersigned, having considered the Memorandum of the Council of the Society of Arts, and the plan therein set forth, for examining and granting certificates to the students of classes for adult instruction in the Literary and Scientific Institutions, Mechanics' Institutes, Athenæums, and other similar bodies in union with the said Society, do hereby declare that we desire to promote the success of the said plan, and are prepared to regard as *testimonials worthy of credit* such CERTIFICATES as may be awarded in conformity thereto:—

J. B. Cantuar (the Archbishop of Canterbury), The Palace, Lambeth.
Frances Anne Vane Londonderry, Holdernesse-house, Park-lane, London.
Auckland (Bishop of Bath and Wells), Wells, Somerset.
Ashburton, F.R.S., Bath-house, Piccadilly, London.
Feversham, 25, Belgrave-square, London.
Fortescue, Castle-hill, Devon.
Londesborough, 8, Carlton-house-terrace, London.
Lyttelton, 10, Great George-street, Westminster.
S. Oxon (Bishop of Oxford), 26, Pall-mall, London.
C. Winton (Bishop of Winchester), Farnham Castle.

Shelburne, M.P., Lansdowne-house, London.
Ebrington, M.P., Bruton-street, London.
Goderich, M.P., 1, Carlton-gardens, London.
Robert Grosvenor (Lord Robert Grosvenor, M.P.), Park-street, London.
Stanley (Lord Stanley, M.P.), St. James's-square, London.
J. R. G. Graham, Bart., M.P., Netherby, Cumberland.
Stafford H. Northcote, Bart., M.P., Pynes, Exeter.
John Villiers Shelley, Bart., M.P., Park-lane, London, and Mansfield-park.
Edward Pery Buckley, M.P. (President of the Literary and Scientific Institution, Salisbury), Major-General, South Audley-street, London.
De Lacy Evans, Lieut.-General, M.P., 26, Bryanstone-square, London.
Joseph Bailey, Bart., M.P., 26, Belgrave-square, London, and Glanusk-park, Breconshire.
Wentworth Blackett Beaumont, M.P., Bretton-hall, Wakefield.
William Biggs, M.P., Manufacturer, Highfield-house, Leicester.
John Brady, M.P., Warwick-terrace, Belgravia.
William Brown, M.P., Merchant, Richmond-hill, near Liverpool.
H. M. Cairns, M.P., 79, Eaton-place, London.
T. Challis, M.P. (Alderman), Finsbury, London.
Raikes Currie, M.P., Hyde-park-terrace, London.
I. S. W. S. E. Drax, M.P., Charbro'-park, Dorset.
Edward C. Egerton, M.P., 13, Lowndes-square, London.
William Ewart, M.P., Cambridge-square, London.
John Fergus, M.P., Kirkaldy, N.B.
Joseph Ferguson, M.P., 13, Devonshire-place, London.
William Johnson Fox, M.P., 3, Sussex-place, Regent's-park, London.
James Johnstone, M.P., 10, Wilton-place, London.
W. S. Lindsay, M.P., Shipowner, Austinfriars, London.
George Moffatt, M.P., 103, Eaton-square, London.
James Henry Porteus Oakes, M.P., Oxford and Cambridge Club, London
Benjamin Oliveira, M.P., F.R.S., Upper Hyde-park-street, London.
Charles William Packe, M.P., Richmond-terrace, Whitehall, London.
Joseph Paxton, M.P., Sydenham, London.
Apsley Pellatt, M.P., Staines.
Melville Portal, M.P., Laverstoke-house, Hants.
Robert Stephenson, M.P., F.R.S., President of the Institution of Civil Engineers.
William Tite, M.P., F.R.S., 42, Lowndes-square.
Samuel Warren, M.P., Q.C., 35, Woburn-place, London.
W. Wells, M.P., 22, Bruton-street, London.

John F. W. Herschel, Bart., F.R.S., &c., Collingwood, Hawkhurst, Kent.
J. Appleyard, Mayor of Halifax, Yorkshire.
Charles Babbage, F.R.S., 1, Dorset-street, Manchester-square, London.
Edward Baines, Editor of the *Leeds Mercury* (and President of the Yorkshire Union of Mechanics' Institutes), Leeds.
Arthur Kett Barclay, F.R.S., F.A.S., F.G.S. (Barclay, Perkins, and Co.), Bury-hill.
Joseph Carne, F.R.S., Penzance.
William Charley, J.P., Seymour-hill, near Belfast.
R. Q. Couch, President of the Penzance Institute.
William Sands Cox, F.R.S., F.R.C.S., Dean of the Faculty, Queen's College, Birmingham.
Davy, John, M.D., F.R.S., Lesketh-house, Ambleside.
Robert Forman, J.P., Derby.
A. W. Hofmann, Ph.D., F.R.S., Royal College of Chemistry, London.
Henry Thomas Hope, 116, Piccadilly, London.
R. W. Jelf, D.D., Principal of King's College, London.
J. W. Lubbock, F.R.S., Banker, High-elms, Farnborough, Kent.
John Mercer, F.R.S., Oakenshaw, near Accrington.
W. Mordey, J.P., Chairman of the Sunderland and South Shields Water Company, Sunderland.
Sampson Payne, Mayor of Southampton.
Robert Pegg, Mayor of Derby.
Wyndham S. Portal, Malshanger, Basingstoke, Hants.
John Stewart, Mayor of Liverpool.
Edward Thring, M.A., Head Master of Uppingham.
W. Williams, M.A., Vicar of St. Bartholomew, Hyde, Winchester.

The Commercial Bank of London (per Alfred R. Cutbill, Manager), Lothbury, London.
The London and Westminster Bank (per J. W. Gilbart, F.R.S., General Manager), Lothbury, London.
Cork and Bandon Railway Company (per H. Williams Wood, Secretary), 17, Gracechurch-street, London.
The Great Northern Railway Company (per J. R. Mowatt, Secretary), King's-cross, London.
The London, Brighton, and South Coast Railway Company (per Frederick Slight, Secretary), London-bridge.
The South Eastern Railway Company (per S. Smiles, Secretary), London-bridge.
Joshua Williams, Manager of Vale of Neath Railway, Neath, Glamorganshire.

The Electric Telegraph Company (per J. S. Fourdrinier, Secretary), Lothbury, London.
The Submarine Telegraph Company (per Fred. Cadogan, Deputy Chairman), 30, Cornhill, London.
Travellers and Marine Assurance Company, Poultry, London.
Price's Patent Candle Company, Belmont, Vauxhall, London, and Liverpool.

G. M. Bell, Secretary, London Chartered Bank of Australia, 17, Cannon-street, City.
John Brown, Banker, 25, Abchurch-lane, City.
Hugh Innes Cameron, Banker, Hyde-park-gate, Kensington-gore.
J. J. Fenton and Sons, Bankers, Rochdale.
Hanburys and Lloyds, Bankers, 60, Lombard-street, London.
Lubbock, Forster, and Co., Bankers, 11, Mansion-house-street, London.
Bank of London (per M. Mashall, jun., Manager), Threadneedle-street.
Willis, Percival, & Co., Bankers, Lombard-street, London.

Armitage Brothers, Merchants, New-street, Huddersfield.
H. Bannermann and Sons, Merchants, Manchester.
Bennoch, Twentyman, and Rigg, Warehousemen, Wood-street, London.
Craven and Harrop, Merchants, Bradford.
John Dillon (of Morrison, Dillon, and Co.), Wholesale Warehouseman, Fore-street, London.
Samuel Fletcher, Son, and Co., Merchants, Manchester.
Foster, Porter, and Co., Warehousemen and Merchants, 47, Wood-street, London.
Frith, Sands, and Co., Merchants, 8, Austinfriars, London.
W. J. Hall, Wharfinger and Merchant, Custom-house-quay, London.
William Hawes, Skinners-place, Size-lane, City.
A. and S. Henry and Co., Merchants, Manchester.
Kershaw, Leese, and Co., Merchants, Manchester.
Lea and Perrins, Merchants, Worcester.
Samuel Higgs and Sons, Merchants, Penzance.
R. W. Kennard, and Co., Iron Merchants, 67, Upper Thames-street, London.
Thos. Lund and Brother, Commission Agents, Blackburn.
William Lupton and Co., Merchants, Leeds.
Martinez, Gassiot, and Co., Merchants, Mark-lane, London.
James M'Laren and Nephews, Merchants, Manchester.
Moffatt and Co., Fenchurch-street, London.
S. Morley (J. and R. Morley), Wholesale Warehouseman, 18, Wood-street, London.
Mounsey, Janson, and Co., Iron Merchants, Newcastle-on-Tyne.
Potters and Norris, Manchester.
Powles Brothers and Co., Merchants, 17, Gracechurch-street, London.
John Thomas Raworth, Cotton Merchant, Leicester.
Ray, Glaister, and Co., Merchants, 19, Coleman-street, London.
James Shaw and Co., Mill Owners and Merchants, Huddersfield.
Joshua Scholefield and Sons, Merchants, Birmingham.
Springfield, Son, and Nephew, Merchants, 66, Coleman-street, London.
J. Travers and Sons, Wholesale Grocers, 16, St. Swithin's-lane, London.
Matthew Uzielli, Merchant, Hanover-lodge, Regent's-park, London.
Van Wart, Son, and Co., Merchants, Birmingham.
Waters, Lewis, and Co., Merchants, Worcester.
Edward Wood, Merchant, Port-hill, near Burslem.

Thomas Bridgett and Co., Silk Merchants and Manufacturers, Derby.
J. and T. Brocklehurst and Sons, Silk Manufacturers, Macclesfield.
William and Henry Browett, Silk Manufacturers, Coventry.
Campbell, Harrison, and Lloyd, Silk Manufacturers, 19, Friday-street, London.
Samuel Courtauld and Co., Silk and Crape Manufacturers, Braintree, Bocking, Halsted, and London.
Edward Fisher and Co., Silk Spinners, Longroyd-mills, Huddersfield.
John Hall and Son, Silk Throwsters, Orchard-mills, Coggeshall, Essex.
James Houldsworth and Co., Silk Manufacturers, &c., Manchester.
Johnson Brothers, Silk Men, Congleton.
Keith and Co., Silk Manufacturers, 124, Wood-street, London.
Lewis and Allenby, Silk Mercers, &c., 195, Regent-street, London.
Madeley and Frost, Silk Manufacturers, Derby.
W. Rawlinson, Silk Throwster, Taunton, Somerset.
Thomas S. Reed and Co., Silk Manufacturers, Derby.
Thomas R. Shute, Silk Throwster, Watford.
Simpson and Turner, Silk Manufacturers, Derby.
Vavasseur and Rix, Silk Manufacturers, Trump-street, London.
John Woollam, Silk Throwster, St. Alban's.
S. J. Wright and Co., Silk Manufacturers, Derby.
Richard Atkinson and Co., Irish Poplin Manufacturers, College-green, Dublin.

J. L. and C. Bankes, Ribbon Manufacturers, 8, Wood-street, London, and Coventry.
Charles Bray, Ribbon Manufacturer, Coventry.
W. H. and C. Bray, Ribbon Manufacturers, Coventry.
John Cash, Ribbon Manufacturer, Coventry.
John Newman Clarke, Ribbon Manufacturer, Stoke-green, Warwickshire.
S. Hammerton and Co., Ribbon Manufacturers, Coventry.
Hennell, Adams, and Eld, Ribbon and Silk Manufacturers, Coventry and Derby.
Hiffe and Peters, Ribbon Manufacturers, Coventry.
Hood and Ward, Ribbon Manufacturers, Nuneaton.
Henry Newsome, Ribbon Manufacturer, Hertford-street, Coventry.
G. A. Pridmore and Co., Ribbon Manufacturers, Coventry.

Frederick Browett, Trimming Manufacturer, Coventry.

George Ashworth and Sons, Woollen Manufacturers, Rochdale.
John Brooke and Sons, Woollen Manufacturers, Huddersfield.
John and Thomas Clark, Woollen Manufacturers, Trowbridge.
Robert S. Davies and Sons, Woollen Manufacturers, Stonehouse, Gloucestershire.
John Dennison and Son, Woollen Manufacturers, Halifax.
Dicksons and Laings, Woollen Manufacturers, Hawick and Glasgow.
Edmonds and Co., Woollen Manufacturers, Bradford, Wilts.
Robert Gill and Son, Woollen Manufacturers, Galashiels and Inverleithen.
John and Edmund Grundy, Woollen Manufacturers, Bury and Manchester.
Joseph Hirst (late Barnicott and Hirst), Woollen Manufacturer and Merchant, 31, New-street, Huddersfield.
Charles Hooper and Co., Manufacturers, Eastington-mill, near Stonehouse, Gloucestershire.
Hunt, Barnard, and Co., Woollen Cloth Manufacturers, Strand.
James Johnston, Woollen Manufacturers, Newmill, Elgin, N.B.
Joseph Jubb and Sons, Woollen Manufacturers, Batley, near Dewsbury.
Kelsall and Kem, Woollen Manufacturers, Rochdale.

H. C. M'Crea and Co., Merchants and Manufacturers, Halifax.
Marling, Strachan, and Co., Woollen Manufacturers, Stroud.
Morley, Underwood, and Morley, Woollen Manufacturers, Britannia-mills, Leeds.
George Norton, Manufacturer, Clayton West, Huddersfield.
Joseph Norton, Fancy Woollen Manufacturer, Clayton West, and Huddersfield.
William Playne and Co., Woollen Manufacturers, Minchinhampton, Gloucestershire.
P. P. and C. Playne, Woollen Manufacturers, Nailsworth, near Stroud.
Pocock and Rawlings, Broad Cloth Manufacturers, Chippenham, Wilts.
W. R. Rawson and Co., Woollen Manufacturers, Halifax.
Reid and Taylor, Manufacturers, Langholm.
Samuel Salter and Co., Woollen Manufacturers, Trowbridge.
Kenny Scott and Co., Woollen Manufacturers, Ormonde-mills, Kilkenny.
W. B. and G. Sheppard, Cloth Manufacturers, Frome, Somerset.
John Sibbald and Co., Woollen Manufacturers, Galashiels.
William and John Stancomb, Woollen Manufacturers, Trowbridge, Wilts.
Stanton and Son, Cloth Manufacturers, Stroud.
J. H. Whitehead, Manufacturer and Merchant, Southsyal, Saddleworth.
Peter Wilans and Sons, Woollen Cloth Manufacturers, Leeds, Yorkshire.
Wilson and Armstrong, Woollen Manufacturers, Hawick, and 69, Aldermanbury, London.
John Wilson, Woollen Manufacturer, Ladylaw, Hawick.
J. and T. C. Wrigley, Woollen Manufacturers, Huddersfield.

Joseph Schofield and Co., Fustian Manufacturers, Littleboro', Lancashire.

G. W. Addison and Sons, Worsted Spinners, Bradford, Yorkshire.
James Akroyd and Son, Worsted Manufacturers, Halifax.
William Anderton, Worsted Spinner and Manufacturer, Victoria-mill, Bingley, Yorkshire.
William Atkinson and Sons, Worsted Spinners, Cleckheaton, near Leeds.
Samuel Baines, Worsted Spinner and Manufacturer, Brighouse, Yorkshire.
J. and J. Baldwin, Worsted Spinners, Halifax.
E. and R. W. Blake, Spinners, Norwich.
M. Bottomley and Son, Worsted Spinners and Manufacturers, Shelf-mills, near Halifax.
Alfred Burgess and Co., Worsted and Woollen Manufacturers, Leicester.
Cartwright and Warners, Spinners and Manufacturers of Patent Angola Hosiery, &c., Loughborough.
Clabburn, Sons, and Crisp, Manufacturers, Norwich.
John Foster and Son, Worsted Spinners and Manufacturers, Black-dike-mills, near Bradford.
William Geary, Manufacturer, Norwich.
Alexander Hadden and Sons, Worsted Spinners and Carpet Manufacturers, Aberdeen.
Richard Harris and Sons, Manufacturers, Leicester.
E. and F. Hinde, Manufacturers, Norwich, and 82, Watling-street, London.
S. C. Lister and Co., Manufacturers, Manningham-mills, Yorkshire.
Middleton and Answorth, Manufacturers, Norwich.
Robert Milligan, jun. (Walter Milligan and Son), Manufacturer, Harden, Bingley, Yorkshire.
Henry Pease and Co., Worsted Spinners and Manufacturers, Darlington-mills.
William Peel and Co., Manufacturers and Merchants, Bradford, Yorkshire.
Rawson, Donisthorpe, and Co., Manufacturers, Leicester.
William Rouse and Co., Spinners, Bradford.
Titus Salt, Sons, and Co., Worsted Spinners and Manufacturers, Saltaire, Bradford, Yorkshire.
James Sugden and Brothers, Worsted Spinners and Manufacturers, Dockroyd, near Keighley, Yorkshire.
Towler, Rowling, and Allen, Manufacturers, Elm-hill, Norwich, and 46, Friday-street, Cheapside, London.
Christopher Wand and Co., Worsted Spinners, Britannia-mills, Bradford, Yorkshire.
Thomas Wheeler and Co., Elastic Web Manufacturers, Abbey-mills, Leicester.
John Whitmore and Co., Worsted Spinners, Leicester.
Edward Willett, Nephew, and Co., Manufacturers, Norwich, and 63, Friday-street, London.

Henry Brinton and Sons, Carpet Manufacturers, Kidderminster.
Joseph Burch and Co., Carpet Manufacturers, Macclesfield.
Samuel Cooke, Carpet Manufacturer, Mill-bridge, near Leeds.
John Crossley and Sons, Carpet Manufacturers, Halifax.
Henderson and Co., Carpet Manufacturers, Durham.
Watson, Low, and Bell, Carpet Manufacturers, 35 and 36, Old Bond-street, London.
Whitwell and Co., Carpet Manufacturers, Kendal.

Ainsworth and Co., Cotton Spinners and Manufacturers, Church-street-mills, Preston.
Ames, Bush, and Co., Spinners and Manufacturers, Great Western Cotton-works, Bristol.
Elkanah Armitage and Sons, Manufacturers, Manchester.
P. R. Arrowsmith and Co., Cotton Spinners, Bolton.
Thomas Barnes and Co., Manufacturers, Farnworth, near Manchester.
Richard Birley and Co., Cotton Spinners, Manchester.
John Bould, Cotton Spinner and Manufacturer, Ovenden, near Halifax.
George Cheetham and Sons, Cotton Spinners and Manufacturers, Stalybridge.
Joseph Clarke and Brother, Cotton Spinners, Phœnix-mill, Ancoats, Manchester.
J. P. Clarke, Cotton Manufacturers, King-street Cotton-mills, Leicester.
Peter Dixon and Sons, Manufacturers of Cotton Goods, Carlisle.
Walter Evans and Co., Cotton Thread Manufacturers, Derby.
Garnett and Horsfalls, Cotton Manufacturers, Low Moor, Clitheroe.
Gartside and Mayall, Spinners, Union-mills, Oldham.
J. and J. L. Gray, Cotton Spinners, Ancoats, Manchester.
Thomas Haigh and Sons, Cotton Spinners and Doublers, Colne-bridge-mills, near Huddersfield.
Horrockses, Miller, and Co., Manufacturers, Preston.
William Horsfall and Son, Cotton Spinners, Hebdenbridge.
Kingston Cotton-mill Co. (per Francis Gleddon, managing director), Cotton Spinners, Hull.
Langworthy Brothers and Co., Spinners and Manufacturers, Greengate-mills, Manchester.
John Paley and Co., Cotton Spinners and Merchants, Preston, Lancashire.
Charles Pooley, Spinner, Manchester.
John Pooley and Son, Cotton Spinners, Manchester.
Samuel Radcliffe and Sons, Spinners, &c., Rochdale, Oldham, and Manchester.
Joseph Rowland and Son, Spinners and Manufacturers, Oldham.
William Sidebotham, Cotton Manufacturer, Hyde, near Manchester.
Thomas Taylor and Brother, Cotton Spinners, Wigan.
Tillard and Co., Cotton Spinners, Wilne-mills, near Derby.

Joseph Thompson and Son, Cotton Manufacturers, Ardwick, Manchester.
John Whittaker and Sons, Cotton Spinners and Manufacturers, Hurst-mills, near Ashton-under-Lyne.

Thomas Ainsworth, Flax Spinner, Penny-bridge, Ulverstone and Cleator, Whitehaven.
Benyon and Co., Flax Spinners, Leeds.
Carter Brothers, Linen Manufacturers, Barnsley.
Clark, Plummer, and Co., Flax Spinners, Newcastle-upon-Tyne.
William Cowan and Co., Flax Spinners and Manufacturers, White Abbey, Belfast.
Dunbar, McNaster, and Co., Flax Spinners, Linen and Thread Manufacturers, Gilford, Co. of Down, Ireland.
German, Petty, and Co., Flax Spinners, Preston.
William B. Houldsworth and Co., Flax Spinners, Leeds.
Marshall and Co., Flax Spinners, Leeds.
James Murland, Flax Spinner and Manufacturer, Castlewellan, Ireland.
Richardson and Co., Bleachers and Flax Spinners, Lisburn.
James N. Richardson, Son, and Owden, Flax Spinners, Bessbrook, near Newry, Ireland.
J. G. Stuart, Flax Spinner, Balgonie, Markinch.
Erskine Beveridge, Manufacturer of Table Linen, &c., Dunfermline.
Auld, Berrie, and Mathieson, Manufacturers of Muslins, Glasgow.

Ferguson Brothers, Dyers and Finishers, Holme Head-works, Carlisle.
Alexander Harvey and Son, Dyers, Glasgow.
Archibald Orr, Ewing, and Co., Turkey red Dyers and Calico Printers, Glasgow and Bonhill, Dumbartonshire.
Charles Swaisland, Calico Printer, Crayford, Kent.
J. W. George and Co., Stuff Dyers, Leeds.

Adams, Page, and Co., Lace Merchants, Nottingham.
Ayer and Miller, Merchants, Nottingham.
Thomas Ball and Co., Lace Manufacturers, Nottingham.
Copestake, Moore, Crampton, and Co., Lace Manufacturers, Bow Church-yard, and Nottingham.
Elliott and and Cragg, Lace Thread Manufacturers, Island-street-mills, Nottingham.
William Felkin, F.L.S., Manufacturer of Lace and Hosiery, Nottingham.
J. and H. Hadden and Co., Manufacturers, Nottingham.
Heymann and Alexander, Merchants, Nottingham and Bradford.
B. H. Hine, Mundella, and Co., Manufacturers of Hosiery and Lace, Nottingham.
John Thackeray and Son, Lace Thread Manufacturers, Forest-mill, Radford, Nottingham.
John Sowle and Co., Cotton and Lace Manufacturers, Draycott and Bruordash-mills, near Derby.
William Vickers, Lace Manufacturer, Nottingham.
Wild and Bradbury, Lace Manufacturers, Nottingham.

W. and R. Balston, Paper Manufacturers, Maidstone.
James Durham and Sons, Paper Makers, Palerno Paper-works, Currie.
Henry Hall, Paper Manufacturer, Horton Kirby, near Dartford.
Thomas and John Hollingworth, Paper Manufacturers, Turkey-mill, Maidstone.
Alexander Pirie and Sons, Paper Mannfacturers, Stoneywood-works, near Aberdeen.
Thomas Harry Saunders, Paper Manufacturer, Dartford, Kent.
William Sommerville, Paper Maker, Bitton, near Bristol.
Charles Venables, jun., Paper Manufacturer, "Cliefden," "Taplow," "Soho," and "Prince's" Paper-works, near Maidenhead.

Thomas De la Rue and Co., Manufacturing Wholesale Stationers, 110, Bunhill-row, London.
Jennens and Bettridge, Papier Mâché Manufacturers, London and Birmingham.
Robert Besley and Co., Type Founders, Fann-street, Aldersgate-street, London.

Bradbury and Evans, Printers, Whitefriars, London.
William Clowes and Sons, Printers, Stamford-street, London.
Neil and Co., Printers, Edinburgh.
W. and R. Chambers, Publishers, Edinburgh.
Charles Knight, Publisher, Fleet-street, London.
Longmans, Brown, and Co., Publishers, Paternoster-row, London.

Frederick Bankart and Sons, Copper Smelters, Red Jacket-works, Neath, S. Wales.
Leonard Boult and Co., Proprietors of Easton Colliery, Bristol.
G. S. Ford and Sons, Colliery Proprietors, Pyle, near Taibach, Glamorganshire.
Joseph Pease, Coal Owner and Coke Burner, Southend, Darlington.
Thomas Phillips, Knt., Colliery Proprietor, Newport, Monmouthshire, and Temple, London.

Charles Bagnall (of Bagnall and Sons), Iron and Coal Master, West Bromwich.
John Brogden and Sons, Iron Masters, Tondû Iron Works, Glamorgan.
J. Palmer Budd, Manufacturer of Iron and Tin Plates, Ystalefera, Swansea.
The Butterley Company, Iron and Coal-works, Alfreton.
The Coalbrookdale Company (per Charles Crookes), Iron Masters and Founders, Coalbrookdale, Staffordshire.
The Derwent Iron Company, Iron Masters, Consett, near Gateshead.
Gwendraeth Iron and Coal-works, Pembray.
Hird, Dawson, and Hardy, Iron Masters, Low Moor Iron-works, Bradford, Yorkshire.
The Kirkstall Forge Company, Iron Masters, Kirkstall Forge, Leeds.
R. P. Lemon and Co., Iron Masters, Maesteg, Glamorganshire.
William Mathews, Iron and Coal Master, Corbyn's-hall Iron-works, Dudley.
Monkland Iron and Steel Company, Manufacturers of Iron, 160, West George-street, Glasgow.
J. M. Paull, Moor Master to the Commissioners of Greenwich Hospital, Alston, Cumberland.
William Thomas Scarth, Agent to the Duke of Cleveland and Dowager Duchess of Cleveland, Stevenstone, near Darlington.
Jacob Walton, Mine Proprietor, Alston, Cumberland.
Philip Williams and Sons, Iron Masters and Colliery Owners and Workers, Tipton.

W. G. Armstrong and Co., Engineers, Newcastle-upon-Tyne.
I. K. Brunel, F.R.S., Civil Engineer, Westminster.
William Cubitt, Knt., F.R.S., Engineer, Great George-street, London.
Charles May, F.R.S., Great George-street, Westminster.
George Elliot, C.E., Mining Engineer, Houghton-hall, Co. of Durham.
William Fairbairn, F.R.S., Manchester.
Fairbairn and Sons, Engineers, Manchester.
Joseph and James Fox, Engineers and Machine Makers, Derby.
Fox, Henderson, and Co., Engineers and Contractors, London and Birmingham.
R. and W. Hawthorn, Engineers, Newcastle-upon-Tyne.
Benjamin Hick and Son, Engineers, Bolton, Lancashire.
John Hick, Engineer, Bolton, Lancashire.
Humphrys, Tennant, and Dykes, Marine Engineers, Deptford.
Lloyds, Fosters, and Co., Engineers, Wednesbury.

Charles Manby, F.R.S., Secretary to the Institution of Civil Engineers, Great George-street, London.
Pontifex and Wood, Engineers, Coppersmiths, &c., Shoe-lane and Millwall Chemical-works, London; and Garratt Copper-mills, Surrey.
J. M. Rendel, F.R.S., Engineer, Great George-street, London.
J. Scott Russell, F.R.S., of Scott Russell and Co., Millwall, London.
Sandys, Vivian, and Co., Merchants and Steam Engine Manufacturers, Hayle, Cornwall.
Chas. Shepherd, Engineer, Cwmdu Iron-works, Bridgend.
Sharp, Stewart, and Co., Engineers, Manchester.
Thomas Sopwith, F.R.S., Civil Engineer, Allenheads, Newcastle-on-Tyne.
Stothert, Slaughter, and Co., Engineers, Bristol.
Summers and Day, Engineers and Iron Shipbuilders, Southampton.
John Taylor and Sons, Engineers, 6, Queen-street-place, Thames-street, London.
Robert Wood and Sons, Millwrights and Engineers, Larchfield-foundry, Leeds.

Barrett, Exall, and Andrewes, Engineers and Ironfounders, Katespore Iron-works, Reading.
T. and C. Clark and Co., Ironfounders, Wolverhampton.
Clayton, Shuttleworth, and Co., Engineers, Stamp-end Iron-works, Lincoln.
Garrett and Co., Agricultural Engineers, Leiston-works, Suffolk.
Andrew Handyside and Co., Ironfounders and Engineers, Derby.
James and Frederick Howard, Ironfounders and Manufacturers of Agricultural Implements, Bedford.
Ransomes and Sims, Ironfounders and Engineers, Ipswich.

John Abbot and Co., Iron-works, Gateshead-on-Tyne.
Broun, Lenox, and Co., Anchor and Chain Cable Manufacturers, Millwall, Poplar, London, and Newbridge-works, Pontypool, Glamorganshire.
Guest and Ghrimes, Brass-works, Rotherham.
Martineau and Smith, Birmingham.
Edward Perry (Mayor of Wolverhampton), Japanner and Tinplate Worker, Jeddo-works, Wolverhampton.
Richard Perry and Son, Japanners and Tinplate Workers, Temple-street, Wolverhampton.
Ready and Meynell, Gasfitting Manufacturers, Plumbers, and Brassfounders, Wolverhampton.
Frederick Walton and Co., Manufacturers, Old Hall-works, Wolverhampton.

James Davenport, Machine Maker, Rochdale.
John M. Dunlop and Co., Machine Makers, Manchester.
Fairbairn, Greenwood, and Battey, Machinists, Leeds.
William Higgins and Sons, Machinists, Salford, Manchester.
Maclea and March, Machinists, Leeds.
Manlove, Alliott, and Co., Hydro-Extractor Manufacturers, Bloomsgrove-works, near Nottingham.
Platt Brothers and Co., Machine Makers, Oldham, Lancashire.

Joshua Buckton and Co., Engineers' Tool Makers, Well-house-foundry, Leeds.
George Fisher and Co., Steel and File Manufacturers, Hoyle-street-works, Sheffield.
Shepherd, Hill, and Spink, Machine Tool Makers, Leeds.
Slack, Sellars, and Grayson, Saw Manufacturers, &c., Townhead-street, Sheffield.
Smith, Beacock, and Tannett, Machine Tool Makers, Leeds.
Spear and Jackson, Steel and Tool Manufacturers, Etna-works, Sheffield.

G. E. Donisthorpe and Co., Top and Noil Manufacturers, Larchfield-mill, Hunslet, Leeds.

James Dixon and Sons, Manufacturers of Plated and Britannia Metal Wares, Sheffield.
William Fawcett (Mayor of Sheffield), Manufacturer of Plated and Britannia Metal Wares, Sheffield.
Hilliard and Chapman, Cutlers, Glasgow.
Joseph Rodgers and Sons, Cutlery Manufacturers, 6, Norfolk-street, Sheffield.
John Jobson Smith, Manufacturer, Roscoe-place, Sheffield.
Joseph Gillott, Steel Pen Manufacturer, Victoria-works, Birmingham.
William Mitchell, Steel Pen Manufacturer, Birmingham.
William Bartleet and Sons, Needle and Fishhook Manufacturers, Redditch, Worcestershire.

George Bacchus and Sons, Glass Manufacturers, Birmingham.
Chance Brothers and Co., Glass-works, Birmingham.
James Hartlay and Co., Glass Manufacturers, Sunderland.
Molineaux, Webb, and Co., Flint Glass Manufacturers, Manchester.
Pellatt and Co., Glass Manufacturers, Blackfriars, London.
Richard and William, and William Pilkington, jun., Crown, Sheet, and Plate Glass-works, St. Helen's, Lancashire.
R. W. Swinburne and Co., Glass Manufacturers, South Shields, and Newcastle-on Tyne.
The Thames Plate Glass Company (per Joseph Brown, Director), London.

Stephen Green, Manufacturer of Stone Ware, Imperial Potteries, Lambeth.
W. H. Kerr and Co., Royal Porcelain-works, Worcester.
T. J. and J. Mayer, Earthen and China Ware Manufacturers, Dale-hall Pottery, Longport, Staffordshire.
Herbert Minton and Co., China and Earthenware Manufacturers, Stoke-on-Trent.
Samuel Moore and Co., Earthenware Manufacturers, Sunderland.
John Ridgway, China Manufacturer, Cauldron-place, Staffordshire Potteries.
Josiah Wedgwood and Sons, Potters, Etruria, Staffordshire.

Ashby and Horner, Builders, 7, Aldgate, London.
Thomas Brassey, Contractor, Adam-street, Adelphi, London.
William Eassie, Contractor, Gloucester.
J. and C. I'Anson, Builders, Cirencester-place, Mary-le-bone, London.
Henry Lee and Son, Contractors, Belvedere-road, Lambeth, London.
Lucas Brothers, Contractors, Belvedere-road, Lambeth, London.
George Myers, Builder, Ordnance-wharf, Lambeth, London.
Samuel Morton Peto, Bart, Contractor, Great George-street, Westminster.
John Wood, Builder, 18, Blenheim-place, Leeds.

Cookes, Sons, and Meeres, Cabinet Makers, Warwick and Leamington.
J. G. Crace, House Decorator, 14, Wigmore-street, London.
Gilbert J. French, Manufacturer of Church Furniture, Bolton, Lancashire.
Holland and Sons, Upholsterers, 23, Mount-street, Grosvenor-square, London.
Jackson and Graham, Cabinet Makers, Oxford-street, London.

William A. Adams and Co., Railway Carriage Builders, Birmingham.
Richard Andrews, Coachmaker, Southampton.
Brown, Marshall, and Co., Railway Carriage and Waggon Builders, and Contractors, Britannia Carriage-works, Birmingham.

Herbert and Arthur Holmes, Coach and Harness Makers, Derby, Lichfield, and London.
Joseph Wright and Sons, Railway Carriage Builders, Saltley-works, Birmingham.

R. A. Macfie, Sugar Refiner, Liverpool.
Arthur Guinness, Son, and Co., Brewers, Dublin.
Henry Meux and Co., Brewers, St. Giles's, Middlesex.
Truman, Hanbury, Buxton, and Co., Brewers, Spitalfields, London.
Castles and Co., Distillers, Milk-street, Bristol.
Smith and Co., Distillers, Whitechapel Distillery, London.
Hill, Evans, and Co., British Wine and Vinegar Makers, Worcester.
Brown and Polson, Starch Manufacturers, Paisley.
J. and J. Colman, Manufacturers of Mustard, Starch, British Gum, &c., Stoke-mills, Norwich.
Joseph Martin, Rice and Corn Miller, North Shore-mills, Liverpool.
Blundell, Spence, and Co., Colour Manufacturers and Seed Crushers, 9, Upper Thames-street, London, and Hull.
Dixon and Cardus, Linseed Crushers and Artificial Manure Manufacturers, Northam, Southampton.
Warren S. Hale and Sons, Stearine and Composite Candle Manufacturers, 71, Queen-street, City.

S. P. Austin, Shipbuilder, Sunderland.
Alexander Hall and Co., Shipbuilders, Aberdeen.
James Laing, Shipbuilder, Sunderland.
John Laird, Shipbuilder, Birkenhead.
Thomas and William Smith, Shipbuilders, Newcastle-on-Tyne.
W. O. Young, Ship Broker and Owner, Sun-court, Cornhill, London.
Dunlop and Schoales, Shipping Agents, Southampton.
J. R. Stebbing and Co., Nautical and Mathematical Instrument Makers, Southampton.
C. F. Hancock, Goldsmith, 39, Bruton-street, Berkeley-square, London.
Peter Lawson and Son, Seedsmen, Edinburgh, and Great George-street, London.

INDURATING MARBLE OR STONE.

An invention has lately been patented by Mr. H. C. Page, for indurating marble and stone, so as to render them impervious to atmospheric changes, the action of smoke, grease, and such liquids as usually stain marble and stone, and also to render them less quickly acted upon by acids. The object of the invention is to preserve the beauty, colour, and value of the marble and stone, as well as its sharpness when sculptured. The indurating or preparing process may also be adapted to the fixing of colouring matters applied to marble or stone, for producing an ornamental pattern or design upon it. The marble or stone, thus prepared, is said, in practice, to be better adapted for writing upon—that is, cutting letters in marble and stone, and afterwards colouring or gilding them. The colouring matters employed will neither spread nor become absorbed by the stone.

The mode of indurating light-coloured stone and marble is described as follows:—With a clean soft brush or sponge the surface of the marble or stone is wetted with a solution composed of two parts of lime and one part of pearl-ash. The stone is exposed to a gradual heat until it is perfectly dried through, and until it has become sufficiently hot to melt white bees-wax, which is passed quickly over the surface, using either lump-wax or flake-wax, as in practice may be found most desirable. Should the stone or marble be very porous, it may then be necessary to pass the wax two, three, or more times over the surface; and if such surface be polished it should be cleaned off by rubbing with a dry soft rag while the stone is warm, until the surface is perfectly clean and free from dirt and surplus wax. The stone is then cooled by pouring cold water thereon, and when cold, is finished. Marble and stone prepared or indurated by the above process is said to resist the most penetrating oils or staining liquids. Great care should be taken, when the solution is first applied, to have the surface of the marble or stone perfectly clean and free from dirt and dust; at the same time, it is immaterial whether or not the stone be perfectly dry. Care should also be taken while heating the stone for the second or waxing process that no soot, smoke, or grease come near it; the operator should also avoid touching the surface with his hands, as even the moisture from them would leave an indelible mark or stain. Care should also be taken to have the wax as pure as possible, otherwise the stone will be liable to change colour after a time.

The process adopted for producing a variegated pattern or device in colours on marble and stone is as follows:—The surface of the marble or stone to be operated upon should be clean and fine, but not polished. The colouring matters are applied to the surface, and are disposed and arranged, according to the taste and skill of the artist, in imitation of coloured marble, or any particular pattern or device. After this, the stone is subjected to a sufficient degree of heat to melt wax when applied to it, as before stated; and when so applied, the colouring matter, it is stated, will become perfectly fixed, and remain so for an indefinite period of time, without fear of spreading or intermixing of the colours one with the other. When it is desired to preserve the natural colour of any part of the surface of marble or stone, in the production of a variegated pattern or device, there is applied to the entire surface of the marble or stone the solution of potash and lime, as before described, followed by heating, as before stated. White wax is then applied to those parts of the surface of the marble or stone which it is desired to preserve in its original colour, and to the other parts of the surface of the marble or stone, and while warm, the colouring matters necessary to produce the desired pattern or device are applied.

In operating with such colours as would be prejudicially affected by heat, it will be necessary that the marble or stone should be allowed to become cold before applying such colours; after which the stone is again heated, more wax is passed over the entire surface thereof, the surface cleaned, and the process is finished.

The method practised for indurating common stone-work generally is described as follows:—Dissolve one pound of calcined beeswax in one gallon of coal-tar naphtha, and with an ordinary painter's brush pass the above solution repeatedly over the surface of the stone so long as the stone will absorb it, and until the pores are filled. Should the stone be unusually porous, it will then require the solution to be run quickly over the surface three or four times in succession, using the solution proportionately thicker for coarse stone than for fine stone. The surface is then cleaned with pumice stone or other fine grit and clean water, and the process is finished. When it is desired to preserve the natural colour of any particular part of the surface of common stone in operating thereon, to produce a variegated pattern or device, the inventor applies to those parts of the surface the solution of coal-tar-naphtha and wax before-mentioned; the colouring matters are then applied to the other desired parts of the surface of the stone, and, finally, the solution of coal-tar-naphtha and wax is again poured over the surface; the surface is afterwards cleaned off, and the process is then finished. The process in this instance is conducted without the aid of heat, and it must be observed that the above method of indurating stone, where heat is used, will not apply to marble or limestone, or any other description of stone that contains a large quantity of lime for its basis. In operating upon these qualities of stone when very delicate in colour, the indurating process requires that double-distilled camphine be substituted in place of the coal-tar-naphtha, the camphine being mixed with the wax in the proportion of one gallon of camphine to each pound of white wax. When the colour of the stone is not delicate, then the ordinary camphine of commerce will answer the purpose.

Stone and marble indurated by the above process is stated to be well adapted for all kinds of ornamental carving and letter cutting, the stone being less liable to chip than heretofore, and further, in lieu of its being necessary to use a delicate camels' hair brush and spirit varnish to fill in the letters, oil colours may be employed, dashed indiscriminately over the stone, and the surface afterwards simply cleaned, thus rendering the operation of letter writing or colouring on stone and marble more simple, expeditious, and durable than heretofore.

BRUSSELS ECONOMIC EXHIBITION.

The *Journal of the Society of Arts* of May 23rd, 1856, announced that, through the exertions of M. Ducpétiaux, and a few other eminent individuals, seconded by the Belgian Government, an Exhibition would be opened at Brussels on the 25th August, to comprise all articles and appliances calculated to improve the physical and intellectual condition of the working-classes.

This Exhibition will form the foundation of a permanent museum.

The Committee appointed by the Council of the Society of Arts in furtherance of a movement so important to the welfare of the industrial population, is receiving very satisfactory intelligence of the co-operation of various continental countries; and the increasing interest which is evinced among English producers, will render acceptable the following abstract of the Brussels programme:—

Class I.—Buildings of every Description, erected for the use of the Working Classes.—Models, plans, and drawings to scale,* of every description, will, in this section, take the place of bulky objects. It is particularly desirable that the exhibitors should give full explanations and exact specifications, as well as particulars with regard to the results obtained in the case of existing buildings. (a.) *Architecture.*—General external and internal arrangements of buildings of every description, existing or proposed, for the use of the working-classes, such as town and country dwellings for families; furnished model lodging-houses for single men or single females; groups of dwellings, *quartiers* of the working-classes, *cités ouvrièrs;* schools, alms-houses, *crêches*, or public nurseries, and infant schools; public baths and wash-houses, for small and large towns; economic soup-kitchens, &c. (b.) *Building Details.*—Foundations; means for preventing damp; masonry, carpentry, ironmongery; water supply; pavement; flooring; doors and windows, with their accessories, such as hinges, irons, locks, &c.; sinks, sewers, traps, water-closets; purification, supply, and distribution of water; tanks, pipes, filters, stop-cocks, &c.; chimneys, appliances for ventilation; dust-holes; safes; roofing; woodwork and coverings. Appliances for preventing fires; fireproof flooring and stairs; plans for scaffolding, combining safety, convenience, simplicity, and economy. (c.) *Building Materials.*—New materials, or materials insufficiently known; new applications of known materials, *e.g.*, of iron instead of wood; bricks, tiles, tiles for flooring, &c., improved as to material and form; hollow bricks, for various uses, &c.; cheap substitutes for stone, &c.; plasters, mortars, cements, hydraulic cement; bitumens, either for direct use, or for indurating and rendering waterproof sandstone, felt, &c.; wood for timber-work, indigenous and exotic; wood prepared with a view to render it incorruptible or incombustible; wood stained and polished to supersede painting; metals, and especially iron and zinc, as an important element in buildings of all kinds; galvanised, enamelled iron, &c.; articles of glass; cheap ornaments; materials and appliances for painting, white-washing, &c.

Class II.—Furniture and Household Articles.—1. *Heating:* Stoves for heating one or several rooms; cooking-stoves, and ovens with their accessories, coal-scuttles, shovels, tongs, &c.; natural and artificial fuels. 2. *Lighting:* Lamps, candlesticks, lanterns, &c.; oils, candles, and any cheap materials for lighting. 3. *Washing:* Economic apparatus for washing linen, for drying, &c.; ironing appliances of all kinds. 4. *Household Utensils:* for the kitchen, including crockery, &c. 5. *Furniture:* Stools, chairs, &c.; tables, presses, cupboards, lockers, shelves, &c.; paper-hangings, curtains, blinds, looking-glasses, clocks, prints in frames, &c. 6. *Bedding:* Beds, hammocks, bedding, vegetable stuffing for mattrasses, sea-grass or Zostera, &c., as economic substitutes for wool or hair. 7. *Cleanliness. Hygiene:* Washing-stands, basins, tubs, mats, brushes, brooms, &c.; soap, materials for cleaning, articles of ironmongery, &c.

Besides cheapness, neatness of pattern, and strength, furniture and household utensils destined for the working-classes should display ingenious adaptation for their special purposes. Thus, with regard to the appliances for heat and light, it will be necessary to take into consideration the system of combustion and safety against accident from fire. The utensils for the preparation of food should present no sources of unhealthiness. As to furniture, crockery, &c., simplicity ought to be combined with taste. The question as to healthiness is of particular importance in regard to articles of bedding, &c.

Class III.—Clothing and Linen.—1. Specimens of Woven Fabrics: Cotton, flax and hemp, wool, hair, mixed fabrics. 2. Specimens of Linen: Body and household linen. 3. Ready-made Clothes: For men, women, and children. 4. Coverings for the Head: Ditto, ditto. 5. Coverings for the Feet: Ditto, ditto. 6. Haberdashery: Stockings, waistcoats, drawers, gloves, &c. 7. Other Articles connected with Dress: Dreadnoughts, umbrellas, &c. 8. Watches, ornaments, &c. 9. Materials and appliances for making, mending, and preserving clothing and linen.

Class IV.—Food and Preparation of Food.—1. Grain, groats, flour, maccaroni, &c. 2. Vegetables and roots. 3. Preserved and dried fruits. 4. Sugars, syrups, coffee, tea, chicory. 5. Oil, vinegar, salt, pepper, spices. 6. Beverages. 7. Butter, cheese, eggs, honey. 8. Dried, salted, and smoked meat. 9. Dried, salted, and smoked fish. 10. Preserved articles of food in general. Particular attention will be paid to nutritive substances which have not yet been used as food, or which might become useful subsidiary resources and substitutes for food. In this class are also comprised:—1. Means for restoring to a wholesome condition, or for making a wholesome use of, provisions in a tainted or rancid state. 2. Easy and cheap means for detecting adulterations and frauds of alimentary substances. 3. Means for purifying water. 4. Improvements in grinding, and in the preparation of bread, by which these processes may be made cheaper, and the bread rendered better and easier to preserve. 5. Processes and mixtures, with a view to substitute matters equally wholesome, for grain-flour in the preparation of bread. 6. Improvements in the making of butter, cheese, and other preparations of milk. 7. Cheap processes for the preservation of food, &c., capable of being carried out in the households of the working classes. 8. Eligible substitutes for coffee, tea, and other articles of beverages.

Class V.—Tools and Implements used in Manual Labour. Hygiene of Trades and Occupations.—This class comprises all articles used by the working classes in their various occupations, from the spade of the labourer to the plane of the joiner; from the lace-pillow to the needle and the pin. It is desirable to compare the tools and implements of manual labour used in different countries, so as to establish their respective advantages. In the same class are arranged improved sanitary appliances, and means for preventing accidents, injuries, and diseases, to which the working classes are exposed in their various occupations.

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* **Plans, models, and drawings, ought to be, as far as practicable, executed on the metrical scale.**

Class VI.—Religious Worship: Physical, Moral, and Intellectual Education. Recreations.—This class comprises everything relating to the wants of the moral and intellectual life of families and individuals. This includes—I. *Worship, Education, and Instruction.*—*a.* Articles specially relating to domestic worship, religious books, &c. *b.* Apparatus, furniture, and appliances for schools. *c.* Materials for Teaching: Slates, paper, pens, ink, inkstands, penknives, pencils, crayon-holders, rulers, compasses, &c. *d.* Globes, charts, diagrams, plans, engravings. *e.* Books, periodicals, almanacks. II. *Recreations.*—*a.* Music: Simple and easy books, cheap musical instruments for popular use, collections of songs and popular music. *b.* Cultivation of Flowers: Tools and appliances used in gardening, &c. *c.* Gymnastics: Systems and apparatus suitable for adults and children of both sexes. *d.* Games: Cheap playthings of an educational character; popular games.

Every article should have special relation to the wants, habits, and resources of the poorer classes.

The Exhibition will be opened on the 25th of August, and closed on the 5th of October.

Space being limited, very bulky articles, or large collections, cannot be admitted. Exhibitors should limit themselves to sending a single specimen of each article.

In favour of this Exhibition, the Belgian Minister of Finance has consented to admit foreign articles duty free into the building. Duty will only be paid in case the articles should be sold, for which sale the Commission for the Exhibition will give every facility and assistance.

The Minister of Public Works has also been pleased to grant a remission of 50 per cent. upon the charge of transport by the State railways, for articles intended for the Exhibition.

Contributions may be consigned to Messrs. Mertens, Trupel, and Co., 8, Catherine-court, Seething-lane, London, the agents of the Belgian Commission. If the articles contributed are to be returned to England at the close of the Exhibition, the expense of the conveyance to and from Brussels will be charged to the contributors, at the rate of 1s. per cubic foot to Brussels, and the same for the return. On the other hand, if the articles are consigned as donations to the Belgian Government for remaining permanently exhibited in the intended Belgian Economic Museum, no trouble or expense will be incurred by the contributors beyond the delivery of their goods to Messrs. Mertens and Co.

As a large number of leading men of various countries have been invited to attend the Conferences at Brussels during the Exhibition, very extensive publicity will be secured for all the articles exhibited.

It is desirable that no time should be lost in applying to Messrs. Mertens and Co. for forms, to be filled up with information for insertion in the catalogue.

THE EXHIBITION OF ART TREASURES OF THE UNITED KINGDOM.

The approved design for the Exhibition Building to be erected in Manchester is now on view at 23, Cockspur-street. Mr. Young, who is constructing the Buildings for the Royal Commissioners at Kensington Gore, is the successful competitor, and he has undertaken to complete the building at Manchester by New Year's Day, for £24,500. It will cover rather more than three acres of ground, which compared to the 19 acres of the Great Exhibition, and the like area of the Crystal Palace, will make it appear but a small structure. Additional room will, however, be afforded by the construction of galleries. The extreme length of the building will be 704 feet, and the extreme breadth 200 feet. The materials employed will be for the most part cast and corrugated iron, glass being used only in the centre of each compartment of the roof. The whole of the interior will be lined with wood, while the end appropriated for the grand entrance will be of ornamental brickwork. The walls on which the pictures will be hung will thus be quite safe, and free from all damp. The *coup-d'œil* of the nave is expected to be very effective and imposing, with its trophies of old armour, costumes, implements of chase, banners, and antiquities, illustrative of English life and history in bygone times, from the time of Queen Victoria to the time of Queen Anne—from the time of Queen Anne to the time of Queen Elizabeth, and Henry VIII., and Edward III., and William the Conqueror; with mediæval remains, even to the antiquities of the remotest period of our history. There will also be groups of sculpture, with its thousand objects in stone, marble, alabaster, plaster, wood, ivory, terra cotta, and bronze. There will also be decorative furniture, with all the art luxuries of material life, and goldsmiths' work, and all the curious devices wrought in precious metals; glass—Venetian, German, French, and English; china, delf, and tapestry. In addition there will be the great picture gallery, with a fair prospect of that most important, but rarely attained desideratum, good lighting. A site, excellent in all respects, has been chosen. It is entirely free from the manufactories and their smoke; the Manchester South Junction and Altrincham Railway, which is in connexion with all the railways coming into the city, adjoins the plot of ground, so that contributions may be brought into the building without change of carriage, and visitors will be deposited without trouble or extra expense.

There it is hoped to collect in one gallery the pictures of our best modern artists, the choicest specimens of foreign schools, the works of the best sculptors, together with the numerous objects which come under the denomination of fine arts, which are distributed in private houses throughout the country, instead of being found, as on the Continent, in national collections, accessible to the public. The Committee offer every security, and will effect insurances against all risks; the guarantee fund has now reached upwards of £70,000. They will also defray all expenses connected with the transmission of contributions to and from the building.

The catalogue is under the superintendance of Mr. Peter Cunningham.

The following letter from his Royal Highness Prince Albert, to the President of the Manchester Exhibition, was not originally intended for publication, but as it was written in the hope of being useful to the Committee of this undertaking, H.R.H. has condescended to leave it entirely to them to make such use of it as might best serve their purpose:—

"My Dear Lord Ellesmere,—I was very sorry not to see you with the deputation from Manchester that came to me yesterday upon the subject of the exhibition of art treasures which it is proposed to open in that city in May, 1857. Lord Overstone, however, as well as the other members of the deputation, left nothing to desire in explaining the objects which they have in view. I could not fail to admire the public spirit which has prompted the people of Manchester to enter upon so large and magnificent an undertaking.

"We had a good deal of discussion upon its general principles, upon the soundness and fitness of which much of its future success must necessarily depend.

"Manchester enters upon this undertaking at a certain disadvantage. It has been preceded by the Exhibition of 1851—that of Dublin in 1853—and that at Paris during the last year. That a mere repetition of what has thus gone before would fail to attract sufficient notice and public support, appears to have been felt by the committee, and they most wisely gave a distinctive character to their scheme, by making it an exhibition of what may emphatically be called the art treasures of this country. How to succeed in collecting such treasures, fondly cherished as they are by their owners, who are justly jealous of their safety, is the problem to be solved.

"In my opinion, the solution will be found in the satisfactory proof of the *usefulness* of the undertaking. The mere gratification of public curiosity, and the giving an intellectual entertainment to the dense population of a particular locality, would be praiseworthy in itself, but hardly sufficient to convince the owners of works of art that it is their duty, at a certain risk and inconvenience, to send their choicest treasures to Manchester for exhibition.

"That national usefulness might, however, be found in the *educational direction* which may be given to the whole scheme. No country invests a larger amount of capital in works of art of all kinds than England; and in none, almost, is so little done for art education! If the collection you propose to form were made to illustrate the history of art, in a chronological and systematic arrangement, it would speak powerfully to the public mind, and enable, in a practical way, the most uneducated eye to gather the lessons which ages of thought and scientific research have attempted to abstract; and would present to the world, for the first time, a gallery such as no other country could produce, but for which, I feel convinced, the materials exist abundantly in private hands amongst us.

"As far as painting is concerned, I enclose a catalogue exhibiting all the different schools, with the masters who illustrate them, which able hands have compiled for me, and which was communicated to the National Gallery Committee of 1853, and printed by them with the evidence.

"If such a catalogue, for instance, were filled up with the specimens of the best paintings by the different masters enumerated in it, which exist in this country, I feel certain that the committee would come with very different powers of persuasion and a very different claim to attention to their owners, than when the demand for the loan of certain of their pictures were apparently dependent upon mere accident or caprice. A person who would not otherwise be inclined to part with a picture, would probably shrink from refusing it, if he knew that his doing so tended to mar the realisation of a great national object.

"The same principle might be adopted with regard to the other branches of art, extending even into the field of manufacturing industry.

"Whatever may be the decision of the committee, I assure you that it will give me the greatest pleasure to give you any feeble assistance in support which I may be enabled to render. And I may at the same time repeat to you the assurance of the Queen's best wishes for the success of your labours.—Ever yours truly,

"ALBERT.

"Buckingham Palace, July 3, 1856."

WANDSWORTH TRADE SCHOOL.

On Friday, the 4th of July, the annual examination of this school took place. The examiners were Dr. Playfair, C.B., F.R.S., Mr. Edward Hughes, and Mr. Wylde, from the Board of Trade Department of Science and Art, assisted by the Rev. Dr. Booth, F.R.S.

This school was started about two years since, by the exertions of Dr. Booth and several gentlemen of Wandsworth. The object is to give a more useful and practical education to the children of tradesmen and mechanics than they receive in the ordinary schools. The principles of Science and Natural Philosophy, as applied to industrial pursuits, are taught in addition to the usual subjects of School Education.

The examination in chemistry was conducted by Dr. Playfair, and was very satisfactory. The results of the examination in arithmetic and mechanics, though fair, were not so good. Altogether, the attainments of the scholars were proved to be far beyond what had been expected, considering the disadvantages under which the School labours for want of proper school-room accommodation and suitable apparatus for illustrations in Science.

Among the boys who passed their examination creditably may be mentioned, Bingham, Bright, Boorman, Crossman, Kirby, Proud, Savage, Webb, White, and Wright.

The School now contains upwards of 100 boys, who are regularly instructed in the elements of those sciences and in those subjects which bear more directly upon the ordinary affairs of every-day life. It is hoped the efforts now being made to place the School on a permanent basis will be liberally responded to by the inhabitants of the town. It would be a serious injury to allow such an Institution to die after it has been attended with such important results.

On the evening of the same day, a public meeting in connexion with the School was held in the Assembly Room of the Spread Eagle Hotel, Wandsworth. The Right Hon. Lord Ashburton, F.R.S. in the chair.

The Noble CHAIRMAN, after apologising for his late attendance, observed that the advantages offered by the Trade Schools were immense. The scholars enjoyed privileges in many respects superior to those possessed by the upper classes of society. They had trained schoolmasters, who were not to be found in many of the superior schools with which he was acquainted. The business of teaching required as much study and preparation as any trade. Seven years was not considered too long an apprenticeship to learn a trade. It required as much time to make a good schoolmaster as it did to make a good shoemaker. It would be as presumptuous in him to attempt to discharge the functions of the one as the other. He knew of what materials his dress was composed, but he was entirely ignorant of the knowledge requisite to put those materials together. Another advantage was the possession of good school-books, composed in accordance with the advanced knowledge of the present day. These were advantages far superior to those which he had enjoyed. He trusted the School would receive the support not merely of its patrons, and of those who canvassed for scholars, but also of those who enjoyed its advantages.

Dr. PLAYFAIR said, he had come to inspect the school. As the result of that inspection, he would mention one or two conditions necessary to its improvement. His Lordship had referred to the superior advantages of the education provided by these schools. It was too commonly the case that youths left school as soon as they had learned the alphabet, but they did not know how to form the letters into words. Their education did not embrace instruction in the theory of the work they would have to engage in. They entered life unprepared for its realities, acquired manipulatory knowledge, but remained in perfect ignorance of the principles of their respective trades. It was to supply these wants that these schools had been formed. The ordinary schools did not teach the lad what he wanted before he was removed to earn his own livelihood. If it were found that continuance at school rendered labour more available, the lads would be allowed to remain longer under instruction. The object of these schools was to supply an education supplementary to that of the National schools. They made use of the elementary instruction which had been there imparted, carried it a step further, and turned it to useful and practical purposes. Competition in the present day did not depend upon local advantages, but upon intellect. We were rapidly losing the advantages arising from the possession of coal and iron. Our success must depend on applying scientific principles to the manufacture of the raw material. The principles of these schools could not be carried out unless the instruction commenced where the ordinary schools left off. It was in the hands of the townspeople to make it so. The time of the masters was wasted if lads were admitted who were deficient in elementary knowledge. Every lad admitted ought to read and write well, and be well acquainted with the first four rules of arithmetic. If this school were supported boldly, they could then reject all who were not sufficiently prepared. He hoped this would be done in future. He congratulated them upon the number attending the school. By adopting the course pointed out, though at first it might tend to keep down the numbers, yet ultimately it would increase them and improve the efficiency of the school, while at the same time it would secure the support and co-operation of the National schools. In Bristol they offered scholarships to the most advanced boys. In the course of the afternoon's examination he was satisfied with the acquaintance of the lads with the theory of arithmetic, geography, and chemistry. He, however, found a deficiency, owing to the want of a previous elementary education, in the science of numbers. In Bristol there were admitted in one year sixty-six pupils, and as many were rejected, not being qualified. The result was that the scholars made more rapid progress than the pupils at Wandsworth. Drawing was an important part of education. It cultivated habits of attention and accuracy. It was not here in such a forward state as he hoped it would be next year. This was not the fault of the master, but was owing to a lack of materials. The scholars had a greater knowledge of chemistry than he thought they could have acquired under the circumstances. They were taught abstractedly,—for instance, they answered his questions about sodium although they had never seen it. To teach such sciences effectually they must exhibit experiments; they could not impart instruction effectually by abstractions. Nevertheless, so far, the school had been most decidedly successful. A larger amount of apparatus for illustration was wanted. If the townspeople raised one-third of the requisite outlay, Government would grant the remaining two-thirds. He was aware there had been already heavy demands upon them in starting the school; he was only surprised that they had accomplished so much. He would not have done his duty unless he pointed out to them the deficiencies that existed. He trusted that there would be so much zeal and energy manifested as to ensure success and prosperity for the future.

The Rev. Dr. Booth remarked, that he had for many years held these views with reference to education, but had not, till of late, had an opportunity of putting them into practice. He had submitted them to a few friends in the town, who cordially agreed with them. By their liberality and energy the scheme was started. The contributions amounted to upwards of £300. There had gathered round him men of great energy, friends of education, who devoted themselves to the work. If the school should prove to be a failure, it would not be in consequence of the smallness of the attendance at the classes. They in this respect had met with extraordinary success. One hundred pupils were assembled daily, in a contracted tumble-down place, by no means to be desired for its healthy condition. They were the sons of shopkeepers, engineers, artisans, and others, who were not able to obtain elsewhere that kind of education which they required. The promoters of this school wished to impart a better and higher class of education than could be obtained at National or primary schools. The education at some of the middle-class schools, where three, or even four pounds a year was paid, was of a very inferior and unsatisfactory kind. The managers of the school offered an educational boon to the town, and he trusted it would be duly appreciated. They could not continue their operations much longer in their present building; they required new and suitable premises. A lady of the town had placed at their disposal a site, upon very advantageous terms. It was for them to determine whether the school should continue or whether it should cease. The Committee had made themselves responsible to some extent. It was now for the people of Wandsworth to say whether they would prize the boon, or whether, educationally, their last state should be worse than their first.

Dr. Longstaff observed, that he was gratified with the amount of success which had attended the labours of the Committee. The inhabitants felt interested in educational movements. The room in which they were then assembled was, week after week, crowded at literary and scientific lectures. He had no doubt that Dr. Playfair's suggestion would as speedily as possible be carried into effect.

The Rev. H. Solly moved, that the cordial thanks of the meeting be presented to the Rev. Dr. Booth, for the labour and energy he has bestowed in establishing and carrying on the Trade School. He said that he well remembered the classical education formerly given, and how remarkably deficient it was in imparting a knowledge of those things with which men had to deal in after life. It was very elevating, it was true, but it was very sad to consider that it should supersede other equally, if not more, important education. Young men formerly went out into life ignorant of what the children of National and Infant Schools were now well acquainted with. He had hoped that evening to have heard his lordship speak, as on former occasions, about "common things." It was a duty to make all good things common. Many mistakes were made by the country and by statesmen owing to a want of this knowledge of "common things." Their sisters in former times were receiving a much better education than they themselves. He did not know much about this particular school. He should like to ascertain the precise manner in which practical knowledge was imparted, and how the education was made so valuable that parents could be induced to allow their sons to remain a longer time in the school. One of the strongest stimuli to education had been the throwing open Government situations to competition. He trusted that all civil situations would be thrown open in like manner, from the lowest grade to the most exalted position. It would raise the character of the education imparted in the schools throughout the country.

Dr. Playfair seconded the resolution, and said that the Wandsworth Trade School was the first of the kind established in the kingdom, and could now boast of being the parent of twelve lusty sons in the Provinces. Unless the parent school was supported liberally, the children would speedily outgrow it. Some of these schools were no doubt surrounded by a more numerous affluent population, and were, therefore, able to insist more strenuously upon the conditions of admission. The Trade School at Poplar only admitted lads who were duly qualified. The requirements of the district were considered, and the following branches of study accordingly taught:—Navigation, Shipbuilding, Building, Engineering, and Chemistry. They imparted general instruction first, and then made it apply more especially to some particular branch of trade. The result of their labours had been the formation of an adult school, which had been found so beneficial and attractive, that during the hot months of summer seventy-six persons crowded themselves into an apartment made to accommodate only fifty. Adult persons too frequently wished to select their own studies; this was by no means to be desired, and it was for their benefit that they must always be confined to the peculiar subjects taught in these schools. Firmness, in this respect, would be found ultimately highly beneficial and advantageous. The course in Edinburgh consisted of Arithmetic, Mechanics, Natural Philosophy, and Chemistry. Annually some 600 or 700 persons passed through this course of study. If similar firmness and perseverance were evinced at Wandsworth, not only would the boys, but the parents also, would value and appreciate the education imparted. The scholars would be more highly valued and remunerated than other workmen, and the school would thus be correspondingly appreciated.

Mr. Martin Blackmore expressed his willingness to contribute his share towards the support of the schools.

Mr. Lovel Reeve thought it a difficult matter to work out Dr. Booth's plans in the obscure town of Wandsworth. The School was not sufficiently well-known; would it not supersede the National Schools?

The Rev. Dr. Booth replied that this School was not to interfere with the National or other schools; it was to be supplementary to them. They had received only three pupils from the National School. The Committee of Privy Council on Education thought so highly of the School, that they had made an offer to the Managers, which was embodied in a notice which they had issued, and which he would read:—

> "Notice is hereby given, that a Competitive Examination will be held in November next, at the Trade School, Wandsworth, by Her Majesty's Inspector of Schools, to admit seven boys to receive as exhibitioners a free education for the space of three years in the said Trade School.
>
> "Candidates who are being, or who have been educated at a national or other school in the county of Surrey under Government inspection, and who have completed their tenth, but not their fourteenth year, are admissible.
>
> "They must produce a certificate of age and of good conduct from their last teacher, and from the managers of their school, or from some respectable householder, if they are not now at school.
>
> "The Examination will be held in Reading, Writing, and in the Elements of Grammar, Composition, Arithmetic, and Geography."

The Wandsworth Trade School was thus made a kind of University to the other schools of Surrey.

Mr. Robert Wilson moved a vote of thanks to their noble Chairman, which was seconded by Mr. C. Cortsoorn, and carried by acclamation.

The Noble Chairman in returning thanks said, it only needed to create a demand, and Saxon energy would speedily furnish a supply. There was no natural hunger and thirst for knowledge. When the working-classes could be induced to appreciate the education supplied in these schools, the means would be so abundant as to remunerate the teachers and support the school. There was one regulation which he thought militated against the prosperity of the school. That was, a different scale of prices for the rich and poor. There was no objection in principle, but it had got into men's heads that these institutions were founded for the benefit of the rich, and not for the poor. They ought to do everything possible to remove this idea. The Committee had no reason for discouragement; they were going slowly up hill, and doubtless they would soon meet with all the support they needed.

The noble lord then vacated the chair, and the meeting terminated.

Home Correspondence.

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MR. HAWES'S THEORY OF SAPONIFICATION.

Sir,—I regret much that want of leisure prevents my answering the letter of Mr. Jennings so fully as I could wish, but I am constrained to make one or two remarks concerning some of the observations he made in commenting upon my letter in connection with Mr. Hawes's saponification theory.

Now, Mr. Jennings has somewhat fully discussed certain chemical facts which I adduced, and likewise quoted M. Chevreul pretty freely. It is a great pity that before so doing he did not at least make himself acquainted with one most important point, of which he is most lamentably ignorant, viz., *the constitution of stearine*, for he says in his letter "it is impossible to admit the glycerine as an element *in stearine*, whatever we may infer as to tallow." Mr. Jennings will excuse my entering into any further controversy with him upon the theory of saponification after an assertion so absurd, displaying as it does a total ignorance of the whole subject, and an utter misconception of the entire matter under consideration in my letter.

One more remark and I have done. Mr. Jennings, with his pretensions to soap-making knowledge, should be aware that the term *gelatinous matters* I alluded to is what is understood in a practical sense, and does not apply to the animal substance which he has thought proper to identify with my expression.

I beg to conclude with a recommendation to Mr. Jennings to study the nature of stearine, palmatine, and the analogous fatty bodies in the writings of the eminent chemist, who, as I before said, he quotes so glibly, ere he again plunges into antagonism upon these matters. Then, I think, he will not fail soon to discover the chemical fact that stearine and stearic acid are not identical.

I am, &c.,

ALFRED ANDERSON, F.C.S.

Soap Works, Southwark, 9th July, 1856.

Proceedings of Institutions.

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Manchester.—The Directors of the Manchester Mechanics' Institution propose to inaugurate their new building with an Exhibition illustrative of the fine arts, antiquities, scientific inventions, raw materials, industrial products, machinery at rest and in motion, and comprising selections from mechanical employments in actual operation. The floor space in the building, applicable to the purposes of the Exhibition, exceeds 21,000 square feet, with the additional accommodation afforded by the walls for the display of paintings, engravings, &c. With this space at their disposal, and with the experience the directors possess, of the successful working of similar exhibitions in this Institution, they confidently hope to collect materials, and arrange an Exhibition which will sustain the reputation of the Institution, and be not only an object of general attraction, but an important educational instrument throughout the densely populated district of which Manchester is the centre. To aid them in this undertaking, the directors earnestly solicit the loan of objects suitable for exhibition, and also the valuable assistance which may be rendered by suggestions and friendly co-operation. The surplus fund arising from the Exhibition will be devoted to the reduction or liquidation of the debt remaining on the new building after its completion. The carriage of articles to and from Manchester selected for exhibition will be paid by the directors. An insurance will be effected on the building and its contents, and care will be taken to return uninjured the property of contributors. Already the directors have had the promise of contributions from the East India Company, and from numerous leading manufacturers and others. The new building is now rapidly approaching completion, and it is proposed to open the Exhibition in the autumn of 1856. Those gentlemen who are willing to assist the Board by the loan of any of the objects for exhibition should communicate as early as possible with the President of the Institution, Mr. Oliver Heywood, or with the Secretary, Mr. E. Hutchings.

To Correspondents.

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Erratum.—In last number, p. 575, col. 1, line 10, for "Telkin" read "Felkin."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette July 4th*, 1856.]

Dated 14th May, 1856.

1135. William Pollock, Paisley—Improvements in the treatment or manufacture of ornamental fabrics of the lappet class.

Dated 15th May, 1856.

1149. James Young Simpson, M.D., Edinburgh, and Professor Wyville Thomson, Belfast—Improvements in the manufacture or production of lubricating oil from a new material.

1151. Robert Foulds and William Bracewell, Barnoldswick—Certain improvements in power looms, constructed on what is called the loose reed principle.

Dated 2nd June, 1856.

1297. Henry Cartwright, The Dean, Broseley—Improvements in the application of steam cocks to steam engines, and in working such engines thereby.

Dated 3rd June, 1856.

1323. François Auguste Verdeil, M.D., 30, Rue St. Sulpice, Paris—Improvements in obtaining a particular green colouring matter from artichokes and thistles.

Dated 7th June, 1856.

1359. William Denny Ruck, Topping's-wharf, and Victor Touche, 14, Rathbone-place, Oxford-street—Improvements in the manufacture of paper from fibres not hitherto applied to such purpose.

Dated 10th June, 1856.

1377. Carlo Pietroni, London-wall—Improvements in printing on cloth and other fabrics. (A communication.)

Dated 19th June, 1856.

1445. William Hunt, Tonge, near Middleton—Certain improvements in machinery or apparatus for polishing and finishing yarns or threads.

1444. Guilford Lindsay Molesworth, 13, Beaufort-buildings, Strand—An improved pendent child's cot.

1446. George Pye, Ipswich—An improvement in preparing silk.

1448. William Parsons, 18, Pratt-street, Old Lambeth—Improvements in washing and bleaching woven fabrics.

Dated 20th June, 1856.

1451. Edward Henry Cradock Monckton, Bengal Civil Service, and 77, Chancery-lane—Improvements in pianofortes.

1452. John Talbot Pitman, 67, Gracechurch-street—A new method of using the electric current or currents for telegraphic and other purposes. (A communication.)

1453. James Bullough, Accrington—Improvements in looms.

1455. Jonathan Hague, Ashton-under-Lyne—Improvements in machinery or apparatus for manufacturing bands or cords for driving machinery and other purposes.

1456. Michael Thomas Crofton, Leeds—An apparatus for inking stamps used by bankers and others.

1457. Henry Pigott, Glasgow—Improvements in hats and other coverings for the head.

1458. Stopford Thomas Jones, Royal Circus-street, Greenwich, and Josiah Harris, Dolgelly—An amalgamating machine to extract gold and silver, and to separate iron from crushed mineral ores in water.

Dated 21st June, 1856.

1459. Joseph Bennett Howell, Sheffield—Improvements in the manufacture of cast steel tyres.

1460. Emile Ventré, Paris—An improved carton or box for keeping papers or other articles.

1461. George Davies, 1, Serle-street, Lincoln's-inn—Improvements in apparatus for measuring and indicating the leakage of vessels. (A communication.)

1462. Elias Robison Handcock, 16, North Frederick-street, Dublin—Certain improvements in mechanism connected with engines to be worked by steam or other motive power.

1463. William Armand Gilbee, 4, South-street, Finsbury—Improvements in locomotion on railroads, part of which improvements are also applicable to ordinary roads. (A communication.)

1464. Charles Minne and Amand Colson, Brussels—Improvements in making bread.

Dated 23rd June, 1856.

1465. William Valentine Miller, Portsmouth—Improvements in propelling vessels.

1466. Jean Charles Lefevere Lacroix, Heutrégiville (Marne), France—Filthing and shaving the merino, plain satin, and muslin of wool.

1467. James Johnson and William Blackwell, Ashton-under-Lyne—Certain improvements in self-acting mules for spinning.

1468. Goldsworthy Gurney, Bude, Cornwall—Certain improvements for warming and moistening air.

1469. Robert Roger, Stockton—Improvements in machinery employed for the cultivation of land.

1470. James Atkinson Longridge, 17, Fludyer-street, Westminster—Improvements in obtaining and applying motive power for the conveyance of minerals, pumping, and other purposes in mines in which motive power is required.

1471. George Riley, 1, The Grove, Lambeth—An improved refrigerator for cooling brewers' and distillers' worts.

1472. John Miller, Drogheda, Ireland—Improvements in furnaces for more effectually consuming the smoke, and economizing the fuel employed therein.

1473. Henry Hussey Vivian, Bernhardt Gustav Hermann, and William Morgan, Hafod Works, Swansea—Improvements in the manufacture of copper, and in obtaining gold and silver from the ores employed in such manufacture.

1474. George Dyson, Tudhoe Iron Works, Durham—Improvements in the manufacture of iron.

1475. Isaac Atkin and Marmaduke Miller, Nottingham—Improvements in machinery for sewing lace and other fabrics.

1476. Charles Mills, 8, High-street, Camden-town—An improvement in the hammer rails of pianofortes.

Dated 24th June, 1856.

1477. Edwin Hardon and Joseph Henry, Stockport—Improvements in looms for weaving, and in machinery for communicating motion to looms and other machines.

1478. John Taylor, Hackney-road—An improved vessel for containing chemicals for the generation of disinfecting gases.

1479. John Saxby, Brighton—A mode of working simultaneously the points and signals of railways at junctions to prevent accidents.

1480. David Davies, Wigmore-street, Cavendish-square—Improvements in wheel tyres.

1481. Joseph Harrison, Blackburn, and Christopher Gelderd, Lowmoor, Clitheroe—Improvements in machines for warping and sizeing, or otherwise preparing yarns or threads for weaving.

1483. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in railway breaks. (A communication.)

1484. Leonard Bower, Birmingham—An improvement or improvements in the manufacture of bolts, rivets, spikes, screw blanks, nuts for screws, and washers.

1485. Samuel Sinclair Robson, 45, West-street, Gateshead—Improvements in railway and other carriage breaks.

1486. Abraham Pope, Edgware-road—Improvements in the manufacture of steel.

1487. Jules Etienne Lafond, Belleville, near Paris—Improvements in lighting.

1488. Alfred Vincent Newton, 66, Chancery-lane—An improved construction of life boat. (A communication.)

Dated 25th June, 1856.

1489. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvements in engraving glass and crystals. (A communication.)

1491. Michael Allen, 39, Cavendish-grove, Wandsworth-road—An improvement in arranging and working the slide valves of steam engines.

1493. George Armstrong Bates, Wigan—Improvements in apparatus for the prevention of accidents in ascending and descending shafts of mines.

1495. Robert Wilson Chandler, Bow, and Thomas Oliver, Hatfield—Improvements in engines employed for agricultural purposes.

1497. Jules Henri Etienne Mareschal, Paris—Improvements in hydraulic presses.

1499. James Kenyon and Richard Kenyon, Bury—An improved fabric to be used in printing and other similar purposes, and a method of joining or connecting the ends of the same.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 4th, 1856.

48. Joseph Corbett.
52. Charles Jarvis and Thomas Deykin Clare.
66. George John Christian Erhard Hald.
69. William Barrie.
70. Edward Hallen and William Holland Kingston.
71. John Ashworth.
77. Martin Billing and Frederick Augustus Harwood.
110. Thomas Hill Bakewell.
130. Joseph Jesse Comstock.
162. PierreLewisTieffé-Lacroix.
163. Jean Baptiste Pierre Alfred Thierry, jun., Jean Louis Richard, and Baron Henry de Martiny.
225. Jean Baptiste Jules Hyppolite d'Auvergne.
226. Pierre Samain.
261. Henry Tylor.
518. John Brierley.
899. Edmund Richard Southby.
934. Josiah George Jennings.
1045. Henry Edward Brown.

Sealed July 8th, 1856.

80. Jane Ann Herbert.
111. Thomas Dunn.
115. Vincent Scully and Bennett Johns Heywood.
125. Philip Rechten.
131. John Platt and John Whitaker.
173. Henry Elliott Hoole.
200. John Kershaw.
242. Henry Chance.
245. Abraham Pope.
247. Robert Walter Winfield.
253. Thomas Fewster Wilkinson.
255. John Gretton.
274. Francis Preston.
277. Peter Armand le Comte de Fontainemoreau.
309. Thomas Hinchliffe.
329. James Meacock.
404. William Wilcocks Sleigh.
427. James Knowles.
611. Grand de Chateauneuf.
632. Joseph Pegg.
740. William Frederick Thomas.
833. Frederick George Underhay.
903. William Routledge.
953. William Maugham.
1067. Thomas Huckvale.
1096. Edward Daniel Johnson.
1108. James Wallace.
1109. Robert Wotherspoon.

Patents on which the Third Year's Stamp Duty has been Paid.

July 1st.

1613. Thomas William Kennard.

July 2nd.

1611. William Woods Cook.
1636. Ewald Riepe.
1637. Ewald Riepe.

July 3rd.

1615. Robert Anderson Rust.

July 4th.

1631. Stephen Martin Saxby.

July 5th.

1603. Alfred Vincent Newton.

Journal of the Society of Arts.

FRIDAY, JULY 18, 1856.

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BRUSSELS CONGRESS.

The Council have requested their Chairman, Col. Sykes, F.R.S., Mr. Thomas Twining, jun., Vice-President, and Mr. Thomas Winkworth, to represent the Society at the Conferences to be held at Brussels in September next, when questions concerning the manufacturing and commercial relations of countries with each other, and the welfare of the working classes, will be discussed.

AGRICULTURAL STATISTICS.

By Thomas Dawson.

In the report from the select committee of the House of Lords, appointed to inquire into the best mode of obtaining accurate agricultural statistics from all parts of the United Kingdom, at page 32, the following question is put to Sir John Walsham (163):—"In considering the question, is it your opinion there would be any other mode of collecting agricultural statistics which would be more satisfactory or agreeable to the farmers than through the intervention of the Poor-law Guardians?"

I beg leave to submit, in answer to that question, the following outline of a proposed plan for collecting agricultural statistics:—

The ordnance map of the whole of England is now published at the uniform price of 2s. per sheet, I believe, and 6d. per quarter-sheet. This (1-inch) map, I think, may be made use of in this important work to great advantage, in the following manner:—If the sheet, or sheets, and quarter-sheets, comprising a county, were divided, and cut into sections of about six or eight inches square, and made to form the leaves of a book, containing a sufficient number of pages ruled and arranged similarly to Schedule D of the above-mentioned Report, the part of the map thus attached to the book would serve as a field sketch, or working map, on which all the different cultivations could be minutely sketched, and contain small reference numbers, &c., referring to the columns, sketching, valuations, &c., on the pages of the book. From this book and sketch, I believe, all the information really required may be obtained (even the enumeration of the stock), without troubling the farmer in any way, or asking him a question, or employing the complicated machinery of boards of guardians, enumerators, classifiers, clerks, &c.

This method might be considered as a kind of rough survey and valuation of the whole country, in an agricultural point of view; and if the correct data—that of the ordnance map—is taken into consideration, I think it would be admitted that results sufficiently accurate for all practical purposes may be obtained. In estimating and computing the quantities from such a small map, any individual number would necessarily be incorrect; but I think the errors would constantly keep neutralising themselves, or, in other words, the quantity gained in the wheat would be lost in the barley, &c.; and, with the many facilities and appliances that the class of men to whom the work should be entrusted have at their command, the results on the whole would be quite as reliable as the returns of the farmers themselves.

In certain districts, where the old-fashioned system of farming is still adhered to—where the fields are very small, and the arable and pasture very much mixed—a tracing of the tithe commutation map of the parish would be required, in which case the only field work would be to view the land, and insert in each number of the map, W, B, O (wheat, barley, oats, &c.); but generally, and in all the best cultivated districts, the Ordnance map would answer every purpose.

An active and practical surveyor and valuer would be able to perambulate several square miles per day; and by devoting the whole of his time and energies, and having the requisite assistance for the three or four months of May, June, July, &c., he would be able to make a rapid perambulation over the whole of the county, which on an average would contain about 1,200 square miles.

If this plan is considered a practical one, I would suggest that the surveyor should prepare from his field sketch a fair sheet or sheets, showing the entire county, distinguishing the arable, pasture, meadow, &c., by colours; and it will not be considered that the arable and pasture, &c., are mixed so confusedly as not to be distinguished by appropriate colours, even on so small a scale. It would be so to some extent, where the fields are very small; but, generally speaking meadows and pastures, to the extent of some hundreds of acres, lie together; and several arable fields, in the same manner, are generally found together.

This map might be prepared to accompany the returns, if time allowed; if not, it might be prepared, and sent up afterwards for inspection; and this sheet would afford most excellent data for the calculations of the following years, for I believe, if this mode could be carried out, it would only be required triennially, or perhaps every fifth year.

If the returns thus obtained should prove a sufficient basis for those of the two or four following years, the only thing required from the statistical county surveyor would be the working out of the calculations, and a new map, showing the state of the county as affected by the following crop, which would be done for about one-third or one-fourth of the first year's expense.

With regard to the valuation or estimation of the amount of produce per acre, perhaps the safest and most simple plan would be for the statistical surveyor (who would be a practical man, well known, and resident in the county) to communicate with the clerk of the Board of Guardians of every union in the county, as they would be able to obtain a very reliable estimate from the guardians, who are generally practical farmers; and this information, obtained from the actual yield, and from every union in the county, would give a tolerably correct average yield of the whole county.

And I beg further to suggest that this would be an efficient and easily-worked mode of securing the returns of stock in connection with the before-mentioned plan of obtaining the returns of produce. Every guardian being a practical farmer, residing in the parish, each one would be able to furnish an approximate estimate of the whole of the stock in the parish, his own inclusive. This will not appear impracticable, when it is borne in mind that in many parishes there are not more than half a dozen farmers, and in some instances only two. In some places the guardian would probably be a man not having that thorough knowledge of his parish; but he would always be able to avail himself of the services of such a man, who, either from acquaintance with parish business, or "long standing," &c., would be able to furnish the required information. In some instances, also, where the parish is very large, it would be rather a laborious task for the guardian; but, generally, I think it would be undertaken willingly and gratuitously.

The schedules containing the returns of stock would be left with the clerk of the Board of Guardians, and forwarded by him to the surveyor appointed to obtain the statistics of the county, and thereby avoid the necessity of making application to every farmer in the county.

Advantages of the before-described Plan.

1st. Popular with the farmers. 2nd. Simple and economical*, because only required triennially, or every fifth year. 3rd. The map would afford such an excellent test of the accuracy of the compilation. 4th. New features of interest and importance may be engrafted on it if the map is used, *i.e.*, drainage, reclamation of wastes, and the application of the sewage of towns to those districts, &c. It would also afford the data required for the "soil map" required in the geological survey spoken of by Col. James. 5th. The map would be a tangible record of the produce of the country annually, and an object of interest and importance, showing the state of the whole country in an agricultural point of view; it would do so if only taken once in ten years. 6th. There would be a uniformity in the whole of the proceedings if the map were used.

Objections to the Plan.

1st. It is questionable whether the whole of the green crops could be returned. 2nd. Not able to take the returns of stock at the same time. 3rd. Apparent inaccuracy, on account of the small scale of the map. But I think I can prove that, in the whole, the quantities would be quite as correct as those given by the farmers. A per-centage for fences, brooks, &c., would require to be deducted.

By another mode, the services of the relieving officers as enumerators may be dispensed with altogether, thereby effecting a saving (according to one of the estimates) of £16,000.

The Post Office messengers are an organised staff. It is also a permanent and thoroughly well-conducted establishment everywhere; and its machinery is perhaps more perfect than any that could be organised.

If one competent man in each county could have access to the rate-books, or be supplied with a list of the occupiers in every parish (in which there would be no great difficulty), he would then only have to transmit a schedule, and a concise instructional circular, enclosed in another envelope, to every occupier, through the post-office, which said envelope, containing the schedule properly filled up with the returns of both produce and stock, would be returned to the inspector or county surveyor, having his address thereon for that purpose.

In the majority of cases, I believe, the more intelligent class of farmers are not opposed to the measure; and those who may not understand, or are averse to it, at present, would not fail to attend to the filling up of the schedule, and returning the same to the inspector, if it (the envelope) had the usual "On Her Majesty's service."

This would be, if the plan is considered practicable, much less expensive than any other mode that has been suggested, as, I believe, all the circulars, &c., both to the occupiers and when returned to the inspector, might go post-free.

And perhaps by this method a more accurate return of the corn averages might be obtained from the farmers themselves.

ON THE WINES OF HUNGARY.

(Communicated by Count Samuel Szontagh, through Benjamin Oliveira, M.P.)

The first vines were introduced into Hungary during the third century, by the Roman Emperor Probus.

The vineyards in Hungary cover 2,099,754 acres of land, most of the lower ridges, as well as large tracts of the plains, producing yearly not less than 950,000,000 of gallons. For want of foreign markets, the whole of this enormous supply, excepting a small export of wines of Tokay to Prussia and Poland, is consumed by the inhabitants or is kept accumulated in cellars.

One-third of the wine produce is white, amongst which the fine nectar, of a clear yellowish green hue and sweet aromatic flavour, called Tokay, takes precedence. This wine is grown on a volcanic range of hills in the county of Zemphir, by the borough of Tarezal, Arad, Talga, Tolesna, Erdő-bénge, Tokay, and several others, the whole of this district being known under the denomination of Heggallga, and extending over an area of 25 square miles, the principal place in which is Tokay, and hence, the more specific name to that wine. The yearly average produce amounts to 206,000 gallons. There are five classes of Tokay wine: those of first and second are sweet, so-called liqueur wines, which we know in England under the name of Imperial and Prince's Tokay; the third and fourth classes are what the French call "Vins molleux;" the fifth class belongs to the category of dry wines.

As to their prices they may be set down as follows:—

1st class, £2 per gallon; 2nd class, £1 per gallon; 3rd class, 10s. per gallon; 4th class, 8s. per gallon; 5th class, 6s. per gallon.

With regard to strength and price, the nearest to the Tokay are the white wines of Ordenburgh and Rust. These are very strong bodied, and of a dark yellow colour. As to their flavour they are inferior only to Tokay. Amongst these, liqueur wines are also to be had. Their prices are 6s. per gallon. The dry wines fetch 3s. per gallon.

The next in rank are the wines of Sixmum, Carlowitz, and of Moszlavina, in Croatia. These are both white and red, and, though very strong, their flavour resembles much that of French Roussillon. The price is from 2s. to 4s. per gallon.

Of dry wines, the most excellent are those of Somlo and Neszmily. Their colour is of a beautifully golden hue, similar to the best Sauterne, on account of their exquisite and powerful flavour. Their prices are from 1s. to 2s. per gallon.

Equally distinguished white wines are those of Bahator, Ermellek, Arazgarast, Szereduze, and Badasowy. These are like Rhine wines of prime quality, and possess a bright colour and strong flavour. Their prices vary from 1s. to 2s. per gallon.

Of *red wines*, comprising two-thirds of the produce, there are many excellent varieties, which, in strength, fire, and flavour, may easily compete with the best Burgundy, one particularly, that of Ménes, according to the accounts of several French travellers, amongst whom Count Odart, who inspected the Hungarian wines at the order of the French Government—surpasses even the most celebrated French red wines.

The first rank amongst the red wines takes that of Ménes, in the county of Arad: the yearly produce amounting to 30,000 gallons. The wines are classed into so-called liqueur and dry wines. Their prices being of the former from 12s. to 16s. per gallon, and the latter, from 2s. to 4s. per gallon.

Next come those grown on the hills of Eslaw, Visonta, Buda, Szegszard, Villany, Ecseg, Carlowitz, and Moszlavina. They generally fetch from 1s. to 4s. per gallon.

Besides the above mentioned wines, there are numerous other places where excellent kinds of red as well as white wines are grown, the price of which, according to their quality, varies from 1s. to 6s. per gallon.

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* I have not given an estimate in detail of the expense of obtaining the returns by this mode, but I find I can perambulate nearly a square mile per hour. An average sized county of about 1,200 square miles would be done for (including everything) about £420, making, for the whole of England, £16,800. The mode of an inspector for each county to obtain them through the post office, would be done for about half.

FIBRE OF THE "DHENROOS" OF BENGAL.

(*Hibiscus Esculentus.*)

Some time since, some samples of paper, made from the fibre of the "Dhenroos" of Bengal (*Hibiscus Esculentus*), together with a specimen of the fibre itself, were forwarded to the Society by Mr. A. H. Blechynden, the Secretary of the Agricultural and Horticultural Society of India, with a view to obtaining a report thereon. These specimens had been submitted to Dr. R. Riddell, Superintending Surgeon at Bolaram, extracts from whose letters, given below, were sent as affording full information:—

Extract of a Letter from Dr. R. Riddell, dated Bolaram, 23rd September, 1854, respecting the fibre of the Hibiscus esculentus.

"This fibre, though coarser than the plantain, is much whiter, and, I conceive, might be made particularly available for the manufacture of paper, if not for other purposes; and, as it is of quick growth, arriving at perfection in from 13 to 14 weeks in the rains, and about the same time after, three crops could be raised during the year; and it strikes me the plant would grow during the summer months in England, and ripen in the autumn. The natives are fond of the vegetable it bears, and readily cultivate it; and the stem would only be required after the fruit had been removed. The produce of fibre from one plant was an ounce and quarter, whilst the plantain leaf only gave three-quarters of an ounce. The mode of preparing the fibre was pretty similar to the plantain; the stem and branches being cleared of the leaves and shoots with a sharp knife, a slit was made along the stalk for the purpose of dividing the bark easier; it was then laid on the block and beaten, when the bark immediately separated from the wood part and was stripped off, and the fibre cleaned like the plantain, only it appeared to be much quicker done, and so was the silky fibre from the Muddar (*Asclepias gigantea*); it was beaten out almost at once a pure white."

Extract of a Letter from Dr. R. Riddell, dated Bolaram, 13th February, 1855.

"In a former communication on the subject of Indian fibres I mentioned, when I sent you a few samples, that I thought paper might be made from the *Hibiscus esculentus*, known generally amongst the natives as an "Ambarn." Since then, I have found a manufacturer of coarse paper, who resides in the Bazaar, and have had a trial given to the hemp of the "Bayndie," and which I since learn is to be bought in many parts of the Deccan, from 12 to 14 annas the maund (equal to 1s. 6d. to 1s. 9d. for 80lbs). For 12 seers (24lbs.) here I had to pay one rupee eight annas (three shillings). I enclose you a sample of the paper made from it, and, although coarse, I am led to think the fibre, if prepared with a little more care, and bleached, would produce paper of the best quality. I have fibre prepared under my own direction nearly white, but which I did not like venturing with the paper manufacturer until I had seen the results from the bazaar article. The natives grow the bayndie plant very generally, using the capsule when green as a vegetable, and never pull it up until it has done bearing, when it is pulled, and the leaves, if remaining, stripped off; it is then soaked in water for a time sufficient to loosen the bark from the end, beaten out and dried, the root part of the stem being allowed to remain, and this of course increases its weight to the purchaser. When I gave the hemp to be made into paper I desired the root ends to be cut off, thereby decreasing by so much the quantity of material for the paper, although the man remarked it would make the strongest. My desire was to have as fine a paper as he with his very limited means could produce (merely a wooden beater, a bamboo sieve or frame, and a small chunam lined tank or reservoir). He brought me first a quire as a specimen; and after one ream, size 20 inches by 18, weight 18 pounds, to which if added the previous quire, and the ends of the stalks not used, it shows little loss of material in the making of the paper from twelve seers of the hemp. My object being to ascertain the capability of converting the bayndie fibre into paper, I allowed the man, as an inducement to do his best, to make his own charge, and his charge was three and a half rupees (seven shillings). From the strength and thickness of the paper, there can be no doubt that with the aid of machinery and the fibre better prepared, three reams of good paper might be made out of the same quantity."

Extract of a Letter from Dr. R. Riddell, dated Bolaram, 31st March, 1855.

"I enclose a small specimen of the fibre of *Hibiscus esculentus*, as it is very different from the bayndie hemp as prepared by the natives, particularly in its appearance. Besides, more is procured from one plant by my process than by the usual method of dressing it. The natives soak their bark for nearly two months, and then beat it out; whereas mine is not soaked for more than from 12 to 15 days. The bark when first peeled off the stem is cut in lengths of from six to eight inches, and then soaked in a vessel of water, being well stirred and turned about as the pulp around the fibre begins to soften, changing the water two or three times. It is then taken out and beaten with a round mallet on a block, dashing it with water during this process, after which it is washed and dried. I found the fresh green bark of 40 stems to weigh twelve pounds, and 40 pounds yielded three of fibre, which gives a little more than an ounce to a stem; the latter quantity may be taken as the average. As far as I can judge, the fibre, as prepared by the natives, is in the proportion of about six ounces to ten stems; therefore, if I am correct, my method of preparing the fibre, though a little more tedious, is compensated by the large increase in quantity, and apparently of a better quality for the manufacturing of paper."

The materials have been submitted to Mr. Stones, who writes as follows:—

"Maidstone-wharf, Queenhithe, London,
30th June, 1856.

"Dear Sir,—Having carefully examined the fibre of the *Hibiscus* and the paper made therefrom, upon which you requested my opinion, I have much pleasure in offering the following observations:—

"1st. The fibre is strong, and suitable for the purpose of making paper; although from the smallness of the quantity supplied it is almost impossible to name its market value, but at the price quoted, say 2s. 6d. per cwt. in India, and 7s. per cwt. freight and charges, I have no doubt of its meeting with a ready sale in the English market.

"2nd. The paper sent from India is estimated to be of the value of 44s. per cwt. in its present state, which, deducting 18s. 6d. per cwt. import duty, would leave 25s. 6d. per cwt. as the intrinsic worth of the article in bond.

"If the paper could be supplied of the even texture and surface of the enclosed specimen, its value would be raised to 54s. per cwt.

"The points, therefore, to be determined by the Indian merchant are:—

"1. Whether it would be advisable to ship the fibre with a probability of its realising the price intimated.

"2. Would it be profitable to deliver the paper in London at 25s. 6d. per cwt. in its present condition?

"3. Would it be preferable to attempt to improve the manufacture to such a point as to make the article worth 54s. in London, duty paid?

"Any further information that may be desired I shall be happy to afford. "I am, &c.,

"W. STONES."

SMOKE NUISANCE.

The following invention has been patented by Mr. Doulton, for getting rid of the smoke from pottery kilns: Fig. 1 is a section of a fire-place or furnace of a kiln where fire bars are used, and fig. 2 is a section where no fire bars are employed. *a* is the fire-place or furnace, into which the fuel is placed through the opening *b*, to facilitate which the tile or slab *c* is taken away, and then replaced; *d*, *d*, are perforated fire tiles over an opening *e*, at the upper part of the fire-place or furnace; *f* is part of the outer wall of the kiln; *g* is part of the lining of the kiln; *h* is a chamber above the perforated fire tiles, which can be partially closed by introducing a tile or brick, or otherwise, at the opening *i*, to reduce the quantity of air passing into the chamber *h*, (and consequently to the fire), when the coal has become well ignited. There may be further perforated tiles used above those shown, to partially heat the air before it comes to them, where no fire-bars are used, fig. 2. *j*, *j*, are bricks piled, as heretofore, loosely at the lower part of the furnace or fire-place, as shown, between which air can pass to support combustion, as well as down through the fuel from the chamber *h*. By these arrangements the perforated tiles *d*, *d*, will become highly heated, and the atmospheric air will become heated in passing from the chamber *h*, downwards through the perforated tiles into the upper part of the furnace or fire-place, and will enter above the fuel therein, and thence pass into the kiln through the opening *k*, where it will meet with the products passing off from the fuel, and become ignited with them as they enter the kiln.

Fig. 1.

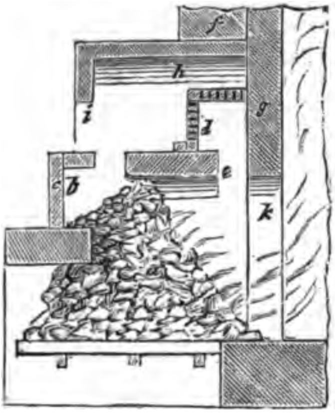
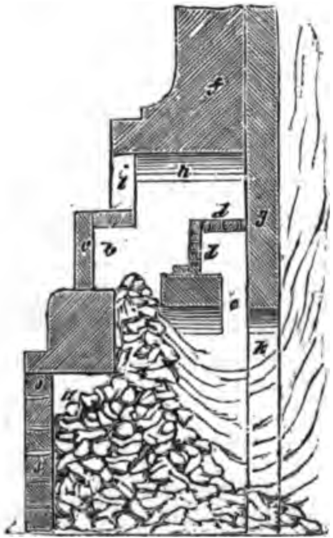


Fig. 2.



COPPER, ZINC, TIN, AND LEAD.

A return has lately been made to the House of Commons, giving accounts "of the exports and imports in the United Kingdom of copper, zinc, zinc ore, and tin, for the year ending with the 5th day of January, 1856;" "and of the exports and imports of lead and lead ore for three years ending with the 5th day of January, 1856." By this return it appears that there have been imported as follows:—

Copper.—Ore, 58,089 tons; regulus, 8,510 tons; unwrought, in bricks and pigs, rose copper, and all cast copper, 3,624 tons; old, fit only for re-manufacture, including all yellow metal sheathing, 1,168 tons; part wrought, viz., bars, rods, or ingots, hammered or raised, 4,419 tons; plates and coin, 269 tons; copper manufactures, and copper plates engraved, 513 tons. The largest ports of import are Swansea and Liverpool, there being imported into Swansea 35,761 tons of ore; and into Liverpool, 17,141 tons. Spain, South Australia, Cuba, the United States of America, Chili, and Bolivia, are the largest sources for the supply of ore.

The total export of British copper was 16,658 tons, consisting mainly of sheets, nails, &c., including mixed or yellow metal. The export of foreign copper was extremely trifling. The exports of British copper during the year were principally to France, the British territories in the East Indies, and the United States of America. The total export of British copper from London was 6,898 tons. The total export of British copper from Liverpool, exclusive of ore, was 5461 tons.

The duty on copper ore having been repealed on the 4th of June, 1853, the quantities admitted to consumption during the period comprehended in the return are identical with the quantities imported, as shown.

Tin.—The total import of tin into the United Kingdom in the year ended 31st December, 1855, was 1,612 tons, principally from Singapore, China, East Indies, and Holland; while the total export of British tin during the same period was 1,347 tons, and of foreign tin 280 tons. The main export of British tin appears to have been to Turkey and France.

Zinc.—The total import of zinc and zinc ore into the United Kingdom for the year ended 31st December, 1855, was, of zinc or spelter, 17,852 tons; and of oxide of zinc, 236 tons. The main supply was imported from Prussia, the Hanseatic Towns, and Belgium. Of zinc and zinc ore exported from the United Kingdom the total amount was, zinc or spelter, British, 2,516 tons; foreign, 2,636 tons; the largest export being to the East Indies.

Lead.—The quantities of lead and lead ore imported into the United Kingdom in the three years ended 31st December, 1855, were:—

	Lead, Pig and Sheet.	Lead Ore.
	TONS.	TONS.
1853	17,564	733
1854	11,858	1,156
1855	7,246	742

Newcastle, London, and Liverpool are the ports to which the main supply is brought, Spain sending us upwards of nine-tenths of the whole quantity imported.

The exports of lead and lead ore during the same periods were:—

	British Lead and Lead Ore.						Foreign Lead.		
	Lead Ore.	Pig and Rolled Lead.	Shot.	Litharge.	Red Lead,	White Lead.	Lead Ore.	Pig and Sheet Lead.	White Lead.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Cwt.	Tons.	Tons.
1853	488	14,935	1,307	316	1,025	1,528	2	1,438	...
1854	104	17,857	1,748	373	1,102	1,814	...	199	5
1855	564	20,466	1,681	230	1,781	3,008	...	97	...

In 1853, Russia took of us 2,818 tons of pig and rolled lead; France, 1,195 tons; and the United States of America, 5,794 tons. In 1854, our principal exports of pig and rolled lead were, to France 1,431 tons; China, 1,926 tons; Australia, 2,893 tons; and the United States of America, 5,558 tons. In 1854, France took 4,359 tons; China, 1,993 tons; Australia, 1,078 tons; and the United States of America, 9,246 tons.

Home Correspondence.

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GUM GLUTEN.

SIR,—I do myself the honour of submitting, for the favour of your inspection, and that of such members of the Society of Arts as may be pleased to take an interest in the same, four specimens of a gum gluten, if such it is, recently collected and prepared by myself from some of the Asclepiadeæ and other plants indigenous to the soil of Goruckpoor, in the Northern and other districts in the East Indies.

2.—I am not aware whether this gum has ever been submitted to the examination of competent talent in Europe or not. Should, however, any mistake have occurred in this respect, I can only offer my apologies for needlessly trespassing upon your time and attention.

3.—This preparation appears in many respects analogous to the genuine gutta-percha of Assam and Mergin, that is, so far as I have had an opportunity of comparing the two productions. It is, however, only very recently that I have seen the gutta-percha in the shape of fabricated articles, and never in its crude state as imported into England.

4.—Several years ago my attention was directed to the examination of the juices of various lactiferous plants of the Northern districts of the East Indies, and after many experiments I had tolerable success in finding an easy and certain process for the instantaneous separation of the gum gluten, as now submitted, from the crude liquids obtained from the plants, but until it may be determined whether the substance has any commercial value at all, it would be premature to enter much into detail, further than to mention that the produce and quality of the gum vary according to the season, some varieties thriving best in the hottest months, when the thermometer stands in the sun's rays at 135° to 140° F., as I have frequently witnessed.

5.—The composition of the juices of one variety of the Asclepiadeæ, from which the gum gluten was separated, I find to be nearly as follows, in the month of September:—

White gum gluten......	6.5	per cent.
Feculine matter	8.0	„
Crystallizable salts,* dry extract	5.5	„
Water	80.0	„

When carefully prepared, this gum gluten, when fresh, is of a pure milk white colour, with a satin-like texture. It hardened on exposure to the air, still retaining for some time its original purity of colour. On immersion in hot water it rapidly softened, and was at once restored to its plastic condition. It might then be extended or threaded out to any length at pleasure, or kneaded like dough, only very much stiffer. Whilst yet warm, it received the impression of a seal, retaining it when cold. It readily effaced the writing of a lead pencil on paper, but it was soiled thereby. These qualities were by no means impaired after long keeping, only the external surface lost its whiteness, and becoming a dark grey, preserved, in some degree, the internal part from further change, which still retained the satin-like texture observed the first time it was prepared. The gum gluten was shown to many parties at the time in India, long before gutta percha was heard of, but it was not then considered (except as a mere matter of curiosity) of sufficient importance to encourage a continuation of the research.

6.—Within the last two or three years, however, my attention was again directed to the subject, chiefly with a view to its possible applicability to photographic purposes. Accordingly, in December, 1853, I had some of the juice collected, but found it exuded rather scantily in the cold season. Being then on circuit duties, several days elapsed before I could operate upon it. The gum, in consequence, became deteriorated, and of a darker colour than it otherwise would have been. It was subjected, moreover, to some experiments which very likely injured it. I had not an opportunity of repeating this experiment at the time, and therefore submit it, just as it is, as a specimen of the gum, modified probably by injudicious experiment, not likely to be repeated in future researches. I have marked this specimen No. 4.

7.—Early in the month of February following, I had about eight pounds or so of the crude sap collected, but from other varieties of lactiferous plants. This yielded nearly 4¾ ounces of the dry gum (about 3.7 per cent). I have numbered the specimen as No. 2.

8.—Later in the season, about the beginning of March, from the same quantity of crude sap, 5½ ounces of the dry gum were prepared (about 4.3 per cent.), which I have marked as No. 1.

9.—In April of the same year, 10½ ounces of the dry gum were separated from about twenty pounds of the crude juice (or about 3.3 per cent. only). This specimen I have called No. 3.

10.—These experiments were made under much interruption, but the amount of produce rather decreasing as the weather became hotter, scarcely seems to corroborate the report of the natives of India as alluded to in the latter part of the 4th paragraph. For the sake of convenience, however, I beg to subjoin the average results in one view:—

Paragraph.	Specimen.	Gathered.	Juice.	Gum obtained.		Per Cent.
7	No. 2	Feb.	8lbs.	4¾ ozs.	=	3.71
8	No. 1	March	8lbs.	5½ ozs.	=	4.3
9	No. 3	April	20lbs.	10½ ozs.	=	3.28
4		Rainy season (Sept.)			=	6.5

But experiments of a more systematic nature are required before the productiveness, or otherwise, of these plants, at particular seasons, can be determined.

11.—Since landing these specimens in England last month, I find they have a degree of brittleness which I did not so particularly notice in India. Difference of climate may be one cause; however, the small round specimen sent with the others (as No. 5) has been boiled for about two hours in a strong solution of caustic potash, and, to me, appears less brittle and of a harder nature than the others. It occurs to me, however, from some trials made as under, that a very slight admixture of oleaginous matter, or of turpentine, would remedy this defect, but I have not enjoyed the opportunity of experimenting on the gum to the extent I could have wished, owing chiefly to the difficulty in collecting chemical re-agents in my remote part of India in a fresh state at the time required. The following, however, may in some degree be useful to record:—

1. COLD WATER.

When the gum gluten is freshly prepared, and flattened out into thin discs of 6 or 8 inches in diameter, and about one-tenth of an inch in thickness, it will float on water, if gently placed on the surface. When both sides are wetted, it gradually sinks, but when once thoroughly dried, it is not much, if at all, affected by immersion in cold water. Whilst under preparation, it obstinately retains, like most vegetable glutens, a large proportion of water—then it is very liable to decompose if kept too long in a wet state. It also acquires a peculiar odour, somewhat, but unpleasantly, resembling cheese; on this account it is very necessary that the gum should be separated from the freshly collected sap, and the preparation concluded with the least delay.

2. HOT WATER.

Hot water softens the gum gluten; renders it plastic;

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* The nature of these salts was not determined; they were decidedly of astringent taste. Some peculiar acid was present, insoluble in nitric acid, and in a chemical point of view worthy of attention. The liquid portion was quite limpid, with an odour more resembling the sweet wort of domestic breweries than anything else with which it could be compared.

when thus softened, it may be kneaded or threaded out to any extent. It will then receive and retain the impression of a seal. As it cools, it again hardens, becoming more or less brittle. This operation may be repeated at pleasure without injuring the properties of the gum. In hot water it appears to be but a slow conductor of heat.

3. Inflammability, &c.

Heated at a candle it melts, and inflames like sealing wax, giving off a dense black smoke, and thick heavy drops of the melted gum fall to the ground.

4. Turpentine.

Oil of turpentine completely dissolves the gum. One fluid ounce of the oil will dissolve about thirty grains or so of the gum, and in this state of solution it makes an excellent cement for uniting broken glass, china ware, or the like.

5. Vegetable Oils.

Cocoa nut oil dissolves it more or less, as it will most vegetable glutens; the action varies with the temperature.

6. Æther.

Cold æther partially dissolves the gum. The æther I had was rather old, but it took up about 30 per cent. of the gum.

7. Spirits of Wine, &c.

These do not dissolve it. I had neither absolute alcohol nor chloroform at hand at the time I was making these experiments.

8. Caustic Alkalies

Have no apparent effect upon the gum-gluten. A portion was boiled for two hours in a strong solution of caustic potash, without dissolving the least portion, as the specimen was weighed both before and after the operation. See paragraph 11.

12.—The crude juice of some of these plants is often used by the natives of India as an external application in cases of cuts and bruises, which speedily heal when thus defended from the air; and the stems and stalks of some of them afford a fibrous matter which future investigation may turn to important account.

13.—In conclusion, I have to apologise for the meagre nature of this hurried statement, prepared since my arrival in England last month, and chiefly from memory, but I beg leave to add, that whenever perfectly convenient, I shall feel greatly obliged by the favour of an opinion on the gum-gluten, now, as I believe, submitted for the first time for examination in England.

I am, &c.,
GEORGE OSBORNE,
Hon. East India Company's Uncov. Service
(on leave of absence.)

22, Pelham-crescent, Brompton, July 8, 1856.

MR. HAWES' THEORY OF SAPONIFICATION.

8, Great Tower-street, 12th July, 1856.

Sir,—Mr. Anderson, in the Society's *Journal* of the 11th July, accuses me of the most perfect ignorance of the "*constitution of stearine.*" This, if it will afford him any gratification, we will not contradict; but then I have given M. Chevreul's definition of the chemical elements of stearine, and, in juxta-position, that of glycerine. Perhaps Mr. Anderson will defer to the authority of the French chemist upon that point. I have quoted only so much of M. Chevreul's work upon the *Corps Gras* as will enable all impartial readers to decide who has understood him best, and who has rendered him most justice.

I am not aware that I have in my paper given any theoretical or practical communications of *my own* upon the subject of saponification; but Mr. Anderson *has* stated, "that he is fully determined to examine the question, so as at once to set at rest the correctness or fallacy of Mr. Hawes' view of saponification." After this pledge, will Mr. Anderson desert this important matter under the shield of my ignorance, instead of adhering to the standard of the sense of Mons. Chevreul, of which he is the voluntary champion?

Mr. Anderson cannot point out any passage in my remarks in which I have sustained, or even hinted, "*the identity of stearine and stearic acid.*"

I am, &c.,
H. C. JENNINGS.

DECAY AND PRESERVATION OF STONE-WORK.

Sir,—At a meeting of the Royal Institute of Architects, on the 28th of November, 1853, the subject under discussion being the "Decay of stone-work, and the best means of preventing it," it was suggested by one of the members that the object of the Institute ought, first, to be directed to the causes of decay; and, having ascertained the disease, then to set about finding an efficient remedy. Upon perusal of this article in the *Builder* newspaper, I was induced for some months afterwards to examine more minutely into the causes of decay, having previously, during the last eleven years, turned my attention to the induration of soft and porous stones, and the best method of arresting the progress of decay in our ancient and modern structures where commenced, and preserving those intact where decay had not as yet made its appearance. Hence, my attention has been directed to the state of the various stone buildings in and about the metropolis, especially with a view of first discovering the cause of the premature decay. My experience, after a variety of tests and trials, leads me to the conclusion that alkaline efflorescence is the primary cause of the decay in stonework; this effloresence is the result of chemical agency, not the least of which will be found in the cement or mortar employed for "bedding" or jointing the work, as in all cases it may be observed that crystals are found commencing at the angles or joints of the work before the walls are thoroughly dry; and, in the first instance, the disintegration which follows proceeds from the alkaline matter contained in all cements and mortars now in general use. In many cases it is accelerated by the employment of sea or salt sand, which is too often used, as the damp developed on the internal walls of many of our buildings plainly testifies.

If pieces of Bath or Caen stone, an inch thick, be set with a layer of Roman cement between, and be exposed to the action of the air, it will be found, in the course of three or four years, that the cement will have so acted upon the stone as to render it capable of being crushed by pressure between the thumb and finger, in consequence of its decomposition by the chemical action of the cement. A proof of the destructive effect of salt upon stone-work may be observed in any seaport town. The stone buildings which are exposed to the sea-breezes show plainly this effect. In London and large manufacturing towns the various chemical matters combined with the air form other prolific sources of decay in stone-work. In certain localities, where the atmosphere is comparatively free from these influences, vegetation may be observed as accelerating the progress of decay, as instanced by the stone-work of Hampton-court Palace and the monumental work in the various cemeteries at a distance from the metropolis and large towns. Such are some of the various causes of decay in stone-work.

I have endeavoured to find a remedy, and I believe that I have succeeded. I employ a solution of one part, by weight, of sublimed sulphur, in eight parts of linseed oil, heated in a sand bath to a temperature of 278° Fahr., by which process the vegetable mucus of the oil is precipitated, and the watery particles evaporated, and their place supplied by the sulphur, which is readily taken up by the oil at the above temperature. The solution is applied with a common painter's brush to the surface of the stone, until it will absorb no more. Sulphur is stated by ancient and modern chemists to be insoluble in water, and to suffer no change by exposure to air; and, further, it is known to be a decided foe to vegetation, and its use in bleaching is well known. For these reasons I have selected it as the basis of the indurating medium. The stone so treated becomes extremely hard, almost equal to granite, and, so far as I have been able to test its preserving qualities, a period of four years shows, not only that no decay has taken place, but time seems actually to increase its hardness. It is simple and inexpensive in its application.

I am, &c.,
J. B. DAINES.

5, Little Argyll-street.

Proceedings of Institutions.

LIMERICK.—On Friday, the 10th instant, his Excellency the Lord Lieutenant opened the Athenæum. Amongst those present were the following:—Lieutenant-Colonel Dickson, Alderman Joynt, Alderman Quinlivan, Dr. Evans, J. T. MacSheehy, T.C., Alderman Watson, Francis Ward, T.C., J. T. Devitt, T.C., the Mayor of Waterford, Dr. Geary, J.P., Sergeant O'Brien, M.P., Francis Spaight, J.P., M. Kelly, T.C., Robert Rodgers, J.P., James Barry, J.P., Robert Keays, T.C., Robert M'Murry, W. O'Hara, T.C., J. J. Quinlan, F. J. O'Neill, Treasurer Limerick Corporation, the Mayor of Cork, Robert M'Mahon, T.C., John M'Donnell, T.C., Thomas Revington, Joseph Merrick, Joseph Fogarty, Robert Anglim, J. C. Patterson, T. M. Usborne, Alderman Tinsley, Thomas E. Carte, J. Barry, T.C., Thomas Boyse, J.P., M. Quin, T.C., Dr. Kane, R. Hunt, Sir Richard De Burgho, Bart, Sir Vere De Vere, Bart., William Phayer, T.C., John Singleton, Rev. Mr. Willis, Joseph Gabbett, Thomas Lake, James Barry, Stamp-office, Dr. J. Elmes, W. E. Elmes, W. E. Corbett, John Basset, W. Mason, Charleville; Rev. Mr. Hegg, Rev. Mr. Bourke, P.P. St. John's; Wm. Johnston, A. W. Harnett, Daniel Doyle, John Quin, Richard Wilson, George Byfield, David Fitzgerald, Rev. John Delmedge, Dr. Murphy, Alfred Allen, Richard Hannan, John Sidley, W. O. Gubbins, M. Dawson, T.C., Dr. White, Inspector of Lunatic Asylums, A. W. Maunsell, Z. M. Ledger, and Dr. Kavanagh. Precisely at one o'clock his Excellency entered the hall, accompanied by Lady Fanny Howard, Miss Howard, the Mayor, Major-General Sir J. C. Chatterton, Bart., and staff, the Earl of Dunraven, &c., when the National Anthem was struck up by the orchestra and chorus, numbering nearly one hundred performers. Alderman Joynt (the President of the Society) read the following Address to his lordship:—"We, the President, Council, and Members of the Limerick Athenæum, beg leave to offer our grateful acknowledgments for the distinguished honour of your Excellency's presence in this Hall to-day. At the moment of its dedication, it may not be inappropriate to recall the reasons which led to its erection, and the objects of its promoters. They knew our ancient and populous city was day by day being rendered more healthy; its public places enlarged; its docks opened to the shipping of the world; its railways securing rapid communication with the rest of the country. They saw the attention which was everywhere bestowed on public health, industry, and commerce; but it seemed to them also that an Institution was required as an aid to popular adult education, suitable for the delivery of literary and scientific lectures, for the promotion of art, and for the cultivation and practice of musical science. The 'suggestions for the establishment of the Athenæum' were no sooner published than many friends of knowledge came forward with voluntary and generous offerings, and the sympathy expressed for the project encouraged its friends to persevere. They did persevere, and resolved to establish an institution, embracing reading and class rooms, a library, a museum, a laboratory, and a lecture-hall. These were to be made available for the local societies then in existence, or which might at any future time be established. Accordingly, the Limerick Literary and Scientific Society, the Harmonic Society, and the School of Art, are now in possession of the building. The Limerick Literary and Scientific Society was founded in 1847, for the purpose of improving its members in composition and the study of general literature. At first, few in numbers, it has gradually increased to over 400; it has extended its operations to the teaching of science by means of lectures, which, for the future, will be delivered here, and has furnished from its own ranks eloquent and useful public lecturers. Its members have decided to establish a Library, to which one of the earliest contributors was your Excellency. The Limerick Harmonic Society is now furnished with a concert room, where classical music can be heard by a large audience. The refining and elevating influence of the society has been acknowledged by all, and by none more than by the working classes. We hope next winter to see the efficiency of the society increased by the erection of an organ. The School of Art was revived in the Athenæum, and its success has outstripped expectation. But as the noble Earl, its President, will present an address to your Excellency, we only indicate its affiliation with our undertaking. A wish having been expressed by many agriculturists of the county and city that a farmers' club should be established here, a room has been set apart for that purpose, and the lecture hall will be thrown open to lectures on agricultural science. Our duty to the generous contributors to the building fund ends to-day; we undertook to expend the money entrusted to our care with whatever zeal and fidelity we could command, and in declaring the building open to the public, your Excellency relieves us from a pleasant though laborious duty. It now becomes the duty of the citizens to see that this building, which has been erected at no slight labour or expense, which shared the contributions of the affluent and the humble, of the lovers of learning and science, may be, by the united action of all, rendered useful to the student in art, to the sons and daughters of the mechanic, the shopkeeper, and the merchant, and may tend, though in a humble way, to spread before their minds those intellectual treasures which raise, refine, and temper the human intellect to its finest issues. We beg to congratulate your Excellency upon the improved state of primary instruction in this city. In all directions schools and institutions of the most admirable character can be found, and the advances made within the last twenty years in Ireland have equalled those of any European country within the same period. We advert to this topic with satisfaction, because we feel primary instruction is the true basis of national improvement in science, art, and literature, and its first advances may be traced to that time when Lord Morpeth was Secretary for Ireland. We believe that nothing contributes so much to the progress of mankind as literature. It endows the individual with power. It is the glory of nations. It is even now, after the lapse of 2,000 years, the glory of that city which gives a name to our institution,

> 'Turn ever to the land
> Where, on the Ægean sea, a city stands,
> Built nobly—pure the air and light the soil—
> Athens the eye of Greece, mother of arts
> And eloquence.'

We feel, to quote your Lordship's words at the Manchester Athenæum in 1846, 'That learning, in any community, will not prove a dangerous thing—that commerce, which has honoured and ennobled a community like this, is the natural ally of literature and art—that the tastes which may here be encouraged, the habits which may here be fostered, are those which give a grace and glory to the lives of men.' We also recognise the force of the lessons taught by the Exhibitions of London, Dublin, and Paris, that to keep pace with the rival industries of Europe and America, the workmen of the empire must be taught the sciences which enter into their respective trades, and thus become educated as well as skilled mechanics. Animated by these convictions we have laboured. If this project be calculated to supply a great public want; if it have in itself aught to recommend it; if it be calculated to help on their march through life those whose early education was neglected, and whose position forbids the acquisition of expensive instruction; if it be guarded as a neutral ground, which political or religious discussions shall never violate, then we will feel abundantly rewarded for our efforts. These efforts were directed towards the promotion of that good cause—the cause of popular education and improvement, of which your Excellency has always been the tried and generous friend. We felt assured of your sympathy. We knew that your Excellency had filled the lecturer's chair, and graced the platform of kindred institutions in England, and we now beg to express our best wishes for your Excellency's happiness, and our gratitude that you have not overlooked our efforts in the contemplation of those material proofs of commercial prosperity and activity, which, during your visit, our native city has presented. Signed on behalf of the Council and Members. William Lane Joynt, President; Richard D. Wilson, Wm. Fitzgerald, Secs."

To this address his Excellency replied as follows:—"Gentlemen,—I request the President, Council, and Members of the Limerick Athenæum to accept my sincere thanks for their most interesting and eloquent address. It has been most agreeable to me upon this occasion of my visiting the city of Limerick, after a long interval, to witness the manifest indications of improvement and enterprise by which I find myself on every side surrounded; but, if possible, it is still more gratifying to find that you have made due provision that the career of national progress should be accompanied and adorned by the yet higher objects of mental and intellectual culture. You have adverted to the still fresh fame of that ancient Athens, upon whose undying forms of natural and architectural beauty it has been my privilege to gaze. Its puny Illussus would indeed immeasureably shrink beside your imperial Shannon. I do not know that the natural intellect of Ireland would dwindle before that of any other race. Bearing a component part in the destinies of a wider empire, under the light of a purer faith, I do not see what limits need be opposed against your advance to any conceivable eminence in knowledge, glory, and virtue."

A selection from Mendelsshon's "Hymn of Praise" was then given by the chorus and orchestra, under the direction of Mr. Handel Rogers, on the conclusion of which his Excellency said,—"I have now the pleasure, in virtue of the high office I hold in this country, to declare the Limerick Athenæum duly opened; and I call upon all present of both sexes to join me in giving three hearty cheers." The orchestra then performed a march, composed for the occasion; followed by the grand chorus from the "Creation,"—"The Heavens are telling;" after which the following address from the Committee of the School of Art was read by the Earl of Dunraven. "The Committee of the Limerick School of Art most respectfully offer their cordial congratulations to your Excellency on visiting this city, and gladly embrace this auspicious opportunity to submit the present state of the Institution to a statesman so eminently distinguished as the patron of science, literature, and art. Since the opening of the School, in 1852, the greatest anxiety has been evinced by the students of all classes to avail themselves of the advantages of art education, and the records of attendance show that their numbers, with reference to the population, has been throughout fully equal to that of any school under the department, and the classification tables exhibit the gratifying fact that a large proportion of these students is drawn from the humbler classes. The Committee refer with satisfaction to the students' works, some of which are now in the School, and to the large number of medals awarded to Limerick at the several prize competitions in London, as a proof that a liberal encouragement of the fine arts by her Majesty's Government will not be thrown away upon Irishmen. The Committee have, however, to express their regret that in consequence of their inability to carry out the new regulations of the Department of Science and Art, they were compelled, in common with other schools, to suspend operations during the greater part of last session, as fully detailed in the report they beg to lay before your Excellency. This interruption was found to be so detrimental to the progress of the students, that the Committee were induced, at their urgent request, to re-open the School at the commencement of the present session, with a determination of giving a fair trial to the self-supporting system, which they feel has already impaired the efficiency and imperilled its future existence, and the Committee are convinced that the Institution cannot be permanently sustained unless aided by the Government or by local taxation. During the first session public approval was evinced by liberal contributions for its support, which was, however, discontinued from a conviction on the part of the public that Institutions should be maintained independent of voluntary aid. The Committee beg to call your Excellency's attention to the Public Libraries Act of last Session, which, though intended by the legislature to enable communities to support Libraries, Museums, and Schools of Art by local taxation, is as yet defective, inasmuch as it does not give the ratepayers the power of limiting the operations of the Act to any of those useful objects singly, which in this highly-taxed city would much facilitate its adoption for the support of this School. In conclusion, your Excellency may be assured that there is no educational institution more appreciated by all classes, or in whose welfare they take a more lively interest, and the Committee would earnestly request your Excellency's powerful assistance towards replacing the School upon its original footing with respect to Government support, at least until some equally efficient mode be devised for establishing it on a permanent basis, and enabling the Committee to promote a branch of education which cannot fail to develope the native genius of the people, while elevating their moral character and advancing them in the scale of social progress by the direction of their talent to a noble pursuit. Signed on behalf of the Committee, Dunraven, President."

His Excellency's reply was as follows:—"My Lord and Gentlemen,—I am happy to express my acknowledgments to the Committee of the School of Art for the address with which they have been pleased to honour me. It gives me much pleasure that the friends of the artistic education of the people have found amongst the industrious classes of Limerick a disposition to enjoy, and an aptitude to profit, by the harmonising and elevating influences which have been found attendant in the enlightened cultivation of Art. The beautiful manufacture of lace for which this district has long been celebrated, is a striking evidence of this capacity. I regret that any circumstances should have occurred to interfere with the full success of your operations. I shall be happy to convey to the proper departments of the Government any representations I may receive on these matters, but you will not be disposed to forget that whatever part governments may legitimately take in fostering talent or genius, they are powerless to create them—the bounty of God must give them, and your own patience and perseverance can alone adequately improve the sacred gift."

The grand Hallelujah chorus brought the proceedings to a close.

MEETINGS FOR THE ENSUING WEEK.

Tues. Zoological, 9.
Sat. Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 20th June, 1856.
285. Imports and Exports (British Colonies)—Return.
Public Records—17th Report of the Deputy Keeper.
Prisons—19th Report of the Inspectors (Northern and Eastern District) Part 2.
Cholera—Epidemics of London (Impure Water)—Report.

Delivered on 21st and 23rd June, 1856.
294. Mercantile Law Amendment Bill—Lords' Report.
272. Writs of Error and Appeals from Courts of Common Law or Equity—Returns.
291. Education (Ireland)—Annual Report of the Commissioners.
292. Light Duties—Return.
184. Bills—Registration of Voters (Scotland) as amended by the Select Committee, and in Committee.
185. Bills—Church Building Commission.
186. Bills—Corrupt Practices Prevention.
188. Bills—Sardinian Loan.
189. Bills—Saint Sepulchre's Manor (Dublin) (as amended by the Select Committee).
190. Bills—Cambridge University (as amended in Committee, on Re-commitment, and on Consideration of Bill, as amended).
191. Bills—Lunatic Asylums (Ireland) (No. 2) (amended).
193. Bills—Intestates' Personal Estates.
194. Bills—Metropolis Local Management Act Amendment (No. 2).

Delivered on 24th June, 1856.
283. Poor Law (Gilbert's Unions)—Return.
289. Bibles, &c.—Return.
290. Fishery Board (Scotland)—Return.
297. Militia Estimates—Report from the Committee.
298. Causes (House of Lords)—Return.
187. Bills—Coatham Marriages Validity.
192. Bills—Dwellings for Labouring Classes (Ireland) as amended in Committee, and on consideration of Bill, as amended).

Delivered on 25th June, 1856.
223. (1) Civil Services, &c., Estimates—Class 8, Vote 9.
235. (1) Petty Sessions—Supplemental Return.
295. Exports—Return.
302. Sale of Lands (Ireland)—Return.
305. Nawab of Surat, &c —Papers.
National Gallery Site—Papers.

Delivered on 26th June, 1856.
39. (5) Trade and Navigation Accounts (31st May, 1856).
303. Militia—Return.
304. Civil Service Estimates, Class 7—Report from the Committee.
195. Bills—Court of Exchequer (Scotland) (amended).
198. Bills—Registration of Leases (Scotland) (amended).
Poor Laws (Ireland)—9th Annual Report.

Delivered on 27th June, 1856.
301. Greenwich Hospital—Copies of Memorial, &c.
304. Civil Service Estimates, Class 7—Report and Evidence.
196. Bills—Joint Stock Companies' Winding-Up Acts Amendment (amended).
197. Bills—Queen's Colleges (Ireland).
199. Bills—Exchequer Bills (£4,000,0 0).
Central America—Further Correspondence.
Recruiting (United States)—Further Papers.

Delivered on 28th and 30th June, 1856.
288. Army (Names of Officers honourably mentioned by Lord Gough)—Return.
307. Cathedral and Collegiate Churches—Return.
312. Chapters—Return.
165. Housebreakings, &c. (Scotland)—Abstract of Return.
281. Military Bands on Sundays—Number of Memorials, &c.
308. Draftsmen of Parliamentary Bills—Return.
309. Poor Relief—Return.
200. Bills—Magdalen Hospital, Bath.
201. Bills—Endowed School at Moulton.
202. Bills—Drainage (Ireland) (amended).
203. Bills—Parochial Schools (Scotland) (amended).
204. Bills—Wills and Administrations (amended).
207. Bills—Oxford College Estates.
209. Bills—Court of Chancery (Ireland) (Receivers).
210. Bills—Court of Appeal in Chancery (Ireland).
211. Bills—Incumbered Estates (Ireland).
Public General Acts—Cap. 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32.

Delivered on 1st July, 1856.
258. Lunacy—10th Report of the Commissioners.
206. Bills—Public Health Act Amendment (amended).
208. Bills—Distillation from Rice.
Sierra Leone (Moriah Chiefs)—Further Correspondence.
Turnpike Trusts (Ireland)—Report of the Commissioner.
British Fisheries—Report of the Commissioners.

Delivered on 2nd July, 1856.
317. Civil Service (East India)—Copy of Further Correspondence.
214. Bill—Turnpike Acts Continuance.

Delivered on 3rd July, 1856.
324. Coalwhipper's Office—Copy of Memorials.
215. Bills—Police (Counties and Boroughs) (as Amended by the Lords).
212. Bills—Church Building Commission (Amended).
213. Bills—Militia Ballots Suspension.
205. Bills—Hospitals (Dublin) (Amended).

Delivered on 4th July, 1856.
266. Fees on Private Bills, &c.—Return.
328. Minerals—Return.
329. Hyde-park—Return.
216. Bill—Commons Inclosure (No. 2).

Delivered on 5th and 7th July, 1856.
306. Mersey Conservancy—Copy of Report.
313. Income Tax—Return.
314. Horses and Carriages—Return.
315. Public Works (Ireland)—Account.
322. Metropolitan Police—Returns.
327. Civil List Pensions—Account.
324. Wines—Return.
336. Bedford Charity—Return.
116. Bills—Partnership Amendment (No. 2) (Amended).
222. Bills—Joint Stock Companies (Lords' Amendments).
Ottoman Empire—Convention.

Delivered on 8th July, 1856.
254 (1). Prisons—Supplemental Return.
318. New Westminster Bridge—Copy of a Report by Messrs. Rendell and Simpson.
220. Bill—Reformatory and Industrial Schools (as Amended by the Lords).
Wreck Chart of the British Isles.
Railways—Report of the Railway Department, Board of Trade.

Delivered on 9th July, 1856.
299. Caledonian Canal—51st Report of the Commissioners.
310. Highways—Return.
340. County Courts—Return.
221. Bills—Divorce and Matrimonial Causes.
223. Bills—Civil Service Superannuation (as amended by the Select Committee).
226. Bills—Criminal Justice.
Fisheries (Ireland)—Report of the Commissioners.
Prisons (Ireland)—34th Report of the Inspectors-General.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette July* 11*th*, 1856.]

Dated 28th May, 1856.
1277. Oldham Whittaker and Cyrus Wallwork, Hurst, near Ashton-under-Lyne—Improvements in weaving figured fabrics.

Dated 4th June, 1856.
1324. Joseph Briggs, Fleet-street—Improvements in blocks and bricks for building.

Dated 9th June, 1856.
1368. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the construction of rails for railways, and in the mode of securing the ends of rails for railways. (A communication.)

Dated 18th June, 1856.
1440. Caleb Perry Sharpley, Berry's-cottage, Chapel-street, Stockwell—Improvements in paddle-wheels for propelling vessels.

Dated 25th June, 1856.
1490. Henrich Ludwig Buff, 9, Fitzroy-square, and Frederic Versmann, 3, Forest-place, Kingsland-road—An improvement in purifying and softening water.
1492. Alexander Keiller, Dundee—Improvements in the manufacture of articles of confectionery.
1494. John Rohead, Glasgow—Improvements in hats and other coverings for the head.
1496. Theofilo Scheller, Waedenschweyl, Switzerland—Certain improvements in obtaining and applying motive power.
1498. James Platt and John Whitehead, Oldham—Improvements in machinery or apparatus for making bricks.
1500. Louis Cornides, 4, Trafalgar-square, Charing-cross—Improvements in ornamental metal, wood, leather, textile fabrics, and other substances.

Dated 26th June, 1856.
1501. Gustave Durrich, Stuttgart, Wurtemberg—Improvements in gas burners. (A communication.)
1502. John Gratrix, Preston, and Alfred Knight, Birmingham—Improvements in apparatus for registering a permanent record of the speed of steam or other engines, which apparatus is also applicable to Watchmen's Registers, and other similar purposes.
1503. Henry Waller, Lickhill, Wilts—Improvements applicable to vessels used in the manufacture of cheese.
1505. David Macdonald, Glasgow—Improvements in printing textile fabrics and other surfaces.
1506. John Portus, Morpeth, New South Wales—Improvements in wheeled carriages.
1507. James Aikman, Paisley—Improvements in the treatment, cleansing, or finishing of textile fabrics.
1508. François Joseph Lucien Malezieux, Paris—Certain improvements in the preparation of peat, and in the manufacture of the same into fuel, charcoal, and gas. (A communication.)
1509. Joseph James Foot, Spital-square—Improvements in weaving narrow fabrics. (A communication.)

1510. Basilio Scariano and Raphael Paul de Villamil, 10, Rue Lepelletier, Paris—Improvements in apparatus for measuring and setting out the forms of garments.

1511. William Hudson, Burnley, and Christopher Catlow, Clithero—Certain improvements in looms for weaving.

Dated 27*th June*, 1856.

1513. Andrew Shanks, 6, Robert-street, Adelphi—Certain improvements in machines for drilling, boring, and cutting metals.

1514. Charles Augustus Preller, Lant-street, Southwark—Improvements in unhairing and preparing skins, and in tanning. (Partly a communication.)

1515. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the production of carbonate of barytes. (A communication.)

1516. Donald Bethune, Cambridge-terrace, Hyde-park—Certain improvements in apparatus for separating the more fluid particles from the more solid of various bodies.

1517. Edward Burnand, Moudon, Canton de Vaud, Switzerland—An improvement in the manufacture of fire-arms.

Dated 28*th June*, 1856.

1518. George Henry Ormerod, Newchurch, Whalley, Lancashire—Improvements in machinery for brushing and cleaning cotton fabrics.

1519. Edward Brown, Henry Street Works, Sheffield—Improvements in the casting of sailors' and other pocket-knife handles, and scales.

1520. George White, 5, Laurence Pountney-lane, Cannon-street, City—An improved poultice. (A communication.)

1521. Eugenio Vincenzi, Turin (Piedmont)—Improvements in Jacquard machines.

1522. Bevan George Sloper, Kentish-town—Improvements in freezing, refrigerating, and cooling, and in the machinery employed therein.

1523. Rev. Robert Reid, Glasgow—Improvements in the treatment or preparation of oils to be used for lubricating.

1524. Edwin Travis, Oldham, and Joseph Louis Casartell, Manchester—Certain improvements in machinery or apparatus for testing or ascertaining the lubricating quality of oils or other unctuous substances.

1525. William McAdam, Glasgow—Improvements in the manufacture of articles of clay and such like plastic substances. (Partly a communication.)

1526. Charles Armand Messager-Abit, 39, Rue de l'Echiquier, Paris—Certain improvements in the treatment of fibrous substances.

1527. Auguste Edouard Loradoux Bellford, 10, Bedford-street, Strand—Improvements in drying, burning, and cooling bricks, tiles, and other ceramic substances. (A communication.)

1528. Richard Orrell, John Cleminson, and William Barraclough, Low Moor, Bradford—Improvements in steam boilers for preventing explosion thereof.

1529. Thomas Frederick Henley, Bromley, Middlesex—An improved process for obtaining arrack or spirit from rice or other grain.

Dated 30*th June*, 1856.

1530. Samuel Jabez Goode, Aston—Improvements in gas stoves, and the application of the same to the ventilation of buildings.

1531. Ebenezer Rogers, Abercarn, and Herbert Mackworth, Clifton—Improvements in cooking, and in apparatus for that purpose. (Partly a communication.)

1532. Alfred Vincent Newton, 66, Chancery-lane—An improved safety pocket for coats and other garments. (A communication.)

1533. Henry Brown, 33, Nelson-square, Nelson-street, Bermondsey, and Job Bartlett, 23, Little Guildford-street, Southwark—The construction of an iron easy arm-chair bedstead.

1534. Cornelius Moriarty, 22, Nelson-street, Greenwich—Improvements in the construction of tube brushes used in cleaning the tubes of marine, locomotive, and all kinds of multitubular boilers.

Dated 1*st July*, 1856.

1535. William Henry Ludford, Fredworth, Gloucestershire—Improvements in the manufacture of brooms and brushes.

1536. Charles Woide Goodhart, Woodlands—Improvements in bars or gratings for the security of buildings and other property.

1537. Frederick George Sanders, Poole—Improvements in the manufacture of ornamental floor and other tiles, bricks, slabs, and other similar articles.

1538. Alfred Wild, Windsor—Improvements in the manufacture of boots and shoes.

1539. John Coope Haddan, Cannon-row, Westminster—Improvements in the manufacture of projectiles, and in firing or discharging them from cannon.

1541. David Graham Hope and William Andrew Fairbairn, Manchester—Certain improvements in steam engines.

1543. George Harvey and Alexander Harvey, jun., Glasgow—Improvements in machinery or apparatus for boring and drilling.

1545. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Surrey—Improvements in propelling and steering vessels when the force of water is used. (A communication.)

1547. John Hay, Hay's Mill, Leith, and James Hay, Edington Mills, Berwickshire—Improvements in the production of pearl barley.

Dated 2*nd July*, 1856.

1549. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of cast steel. (A communication.)

1551. Patrick Heyns, Poplar—Improvements in axles, boxes, and wheels for carriages.

1553. William Frederick Spittle, Birmingham—An improvement or improvements in braiding or plaiting machinery.

1555. William Humber, 9, Dowgate-hill—Improvements in the permanent way of railways.

1557. Thomas Emmanuel Marais, Ferrières la Verrerie (Orne) France—Improvements in railway signals.

1559. William Henry Hubbard, 18, Hemus-terrace, King's-road, Chelsea—Improvements in the manufacture of articles for lighting domestic and other fires.

1561. Alfred Vincent Newton, 66, Chancery-lane—Improvements in air engines. (A communication.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1512. Alfred Ford, 35, Wellington-square, King's-road, Chelsea—Preparing and dissolving in naphtha or oil of turpentine, vulcanized india rubber for the purpose of waterproofing, and for all or any of the other purposes for which the same not so prepared and dissolved is now applicable, and especially for the coating of iron ships' bottoms.—27th June, 1856.

1571. Thomas Key, 122, Brick-lane, Bethnal-green—An improved knife-cleaning machine.—4th July, 1856.

1587. Alfred Louis Stanislas Chenot and Eugene Charles Adrian Chenot, Clichy-la-Garenne, Paris—A method of extracting eliminating extraneous substances from steel sponges.—7th July, 1856.

1588. Alfred Louis Stanislas Chenot and Eugene Charles Adrian Chenot, Clichy-la-Garenne, Paris—Improvements in sorting ores or separating metals from each other, and from certain combinations with other substances.—7th July, 1856.

1589. Alfred Louis Stanislas Chenot and Eugene Charles Adrian Chenot, Clichy-la-Garenne, Paris—Improvements in machinery for compressing metallic sponges and other substances.—7th July, 1856.

1590. Alfred Louis Stanislas Chenot and Eugene Charles Adrian Chenot, Clichy-la-Garenne, Paris—Improvements in apparatus for the reduction of metallic oxyds.—7th July, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 11*th*, 1856.

89. Alexander Bain.
97. William Collett Homersham.
102. Austen Chambers and William Harrison Champion.
103. John Gottlieb Ulrich.
104. Anne Emilie Malteste.
107. Pierre Théophile Auguste Nicoulland.
112. Henry McEvoy.
133. Guiseppe Antonio Tremeschini.
236. Daniel Foxwell.
623. Louis Joseph Richard.
781. Charles Baptiste.
1078. Louis Fréderic Mayer.
1136. Jerome André Drieu.

Sealed July 15*th*, 1856.

113. Henry Law.
118. Johnson Thompson.
127. James Jackson.
132. Wm. Westbrooke Squire.
151. Isaac Barnes.
189. James Pockson.
176. Alexandre Tolhausen.
181. John Hopkinson.
183. Isaac Barnes.
196. Alexandre Tolhausen.
204. Alexander Dalgety.
260. Charles Frederick Claus.
279. Andrew Lamb and John Ronalds.
345. John Wallace Duncan.
478. Robert and William Hawthorn.
514. Charles Alexandre de Fabonne.
642. Thomas Bird and Thomas Rose.
1032. Stephen Carey.
1046. Samuel Reeks.
1162. William Henderson.

Patents on which the Third Year's Stamp Duty has been Pa

July 7*th*.

1669. William Needham and James Kite.

July 8*th*.

1634. James Parkes and Samuel Hickling Parkes.
1635. Thomas Restall.
1652. Joseph Bacon Finnemore.
1673. Richard Archibald Brooman.

July 9*th*.

1656. Andrew Burns.
1703. Samuel Colt.
1774. Griffith Jarrett.

July 10*th*.

1650. George Dalton.
1663. Thomas Hill Bakewell.
1666. Frederick Ransome.
1689. Henry Bessemer.
1692. Isaac Taylor.

July 11*th*.

1651. Felix Lieven Bauwens.
1653. William Lovesley.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3855	July 3.	Sash Fastening..	Simcox, Pemberton, and Sons.	Birmingham.
3856	„ 9.	Indian Tent Lamp and Packing Case ...	Tucker and Son	190, Strand.

Journal of the Society of Arts.

FRIDAY, JULY 25, 1856.

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ELECTION OF ASSISTANT-SECRETARY.

There were one hundred candidates for the office of Assistant-Secretary. To reduce this number, the Council appointed a Committee (on which no Examiner was placed) to investigate the antecedents and claims of the various candidates. This Committee reported the names of sixteen gentlemen as fitting candidates for the office. The candidates were examined by the Rev. Dr. Booth, D.C.L., F.R.S.; Professor Brewer, of King's College; Professor Brown, of King's College; the Rev. W. Elliott; Professor Mariette, of King's College; and Dr. Wintzer, of King's College, who were selected by the Council to conduct the examination.

On the close of the examination, the Examiners returned the names of the five following gentlemen as having acquitted themselves the best in the trial:—

Edward Holmes } equal.
Charles Critchett }
M. H. Wilkin.
Dr. Henry.
J. P. Bidlake.

The Council have elected Mr. Critchett to the office.

EXAMINATIONS FOR 1857.

The Council have determined to hold the Examinations next year during the week commencing the 1st of June, 1857, simultaneously at the Society's House and at some central locality in the North of England, to be settled hereafter as best suited to meet the convenience of distant Institutions.

UNION OF COLONIAL INSTITUTIONS.

At the meeting of the Council held on the 23rd instant, the following Colonial Institutions were taken into Union, in accordance with the Resolution of Council of the 1[illegible]th of December, 1855:—

Graham's Town Medical Society.
Kandy (Ceylon) Agricultural and Horticultural Society.

ON NEGATIVE ARTESIAN WELLS, OR ABSORBING BORED WELLS, AS A MEANS OF DRAINING LANDS, FARMS, BUILDINGS, &c.[*]

By Augustus Edward Bruckmann, Ph. Dr., Consulting Engineer and Geologist.

First Division.—General Considerations.

It is well known that the so-called "artesian wells" represent perforations which are carried down into the different strata of the geological formations, and from which spring-water ascends above the surface of the earth.[†] On the other hand, we must conceive "negative artesian wells," or "absorbing bored wells," as perforations into which are led those waters which it is desired to get rid of, because they are troublesome and detrimental to trade, agriculture, and health; waters which have been hitherto generally got rid of by expensive systems of channels, galleries, sewers or drains, &c., and in later times, in draining for agricultural purposes, by earthenware pipes, &c., a method now generally in use.

When my father, the late J. A. von Bruckmann, the Royal Wirtemberg Government Surveyor of Buildings, introduced artesian wells into Wirtemberg, between the years 1820 and 1830,[‡] he conceived at the same time the idea of establishing absorbing bored wells, and communicated it to me, then his pupil.

In the summer of the year 1827 it happened at Heilbronn, on the Neckar, that in consequence of a heavy thunder storm, acccompanied by a water spout, near the town, a large area of cultivated and fertile fields, situated in a gentle depression of the ground, was entirely submerged; a lake was formed by this accident, the stagnant water of which threatened to destroy all the produce of the field laid under water. In order to get rid of the latter, which for want of a fall in the ground could not be drained in the common way, my father proposed the sinking of an absorbing bore hole at that place, through the diluvium lying on muschel-kalk there. The execution of it was undertaken but not finished, because it so happened that the evaporation in the then hot summer days was so powerful, that the lake disappeared before the perforation had been entirely completed.

This boring was the first in Wirtemberg designedly undertaken for the purpose of carrying off injurious water, and probably the first in the whole of Germany; at least, no account of absorbing bored wells from other parts, even from foreign countries, was known at that time. It is probable that about that time, or, at least, soon afterwards, between the years 1830 and 1840, works of a similar kind were undertaken in France, and, as far as I know, the first account of this subject was given in the year 1833, by Messrs. Girard and Rarent-Duchatelet, in the tenth volume of the "Annales d'Hygiène Publique et de Médecine Légale," under the title, "Des Puits Forés ou Artésiens, employés à l'Evacuation des Eaux Sales et Infectes et à l'Assainissement de Quelques Fabriques; rapport fait à M. le Conseiller d'Etat Préfet de Police." Another treatise on negative artesian wells known to me, was published by M. Arago, in the "Annuaire" for the year 1835, in his very interesting memoir, "Sur les puits forés, connus sous le nom de puits Artésiens, de Fontaines Artésiennes, ou de Fontaines Jaillissantes;" and it has this inscription—"On fore quelquefois le sol pour jeter dans les entrailles de la terre des eaux qui, retenues à la surface sur des bancs imperméables d'argile ou de pierre, rendraient de grandes étendues de pays marécageuses, et impropres à la culture." Another notice on this subject is to be found in the "Annales des Ponts-et-Chaussées for 1835 (tome 13, tirage 1840), p. 126. Besides, M. A. Chevalier wrote on this subject in the "Journal des Connaissances Usuelles," in the month of December, 1835; and so did M. J. Degoussée, in his "Guide du Sondeur" (Paris, 1847). As for Germany, I myself wrote on absorbing bored wells in the "Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg." 9th Jahrgang, 1853, 3 Heft, describing the works which I established for the Count of Maldeghem, in the year 1852; and my treatise is to be found there, under the title "Negative artesische Brunnen (absorbirende Bohrbrunnen) im Molassen—und Juragebirge, zur Ableitung des Wassers aus den Gräflich von Maldeghem'schen Lagerbierkellern in Stetten ob Lonthal" (Mit einem Situationsplan).

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[*] This paper is translated from the German by the author, with considerable modifications and additions, suitable to the English conditions of draining. The author has come to reside in England, with the object of carrying out his plans in this country in suitable localities.

[†] In reference to historical, constructive, and other peculiarities of the artesian wells, see the work by my father and myself:—"Vollstandige Anleitung zur Anlage, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen. Grosstentheils auf eigene Erfahrung gegrundet und fur die praktische Ausfuhrung bearbeitet von J. A. von Bruckmann, Konigl. Wurttemb. Baurath, Ritter des K. Civil-Verdienst-Ordens und seinem Sohne Dr. A. E. Bruckmann, Architekt. Mit neun Steintafeln, Zweite Auflage, Heilbronn am Neckar, I. D. Classische Buchhandlung, 1838. (Erste Auflage, 1833.)

[‡] His Majesty, King William I. of Wirtemberg, bestowed upon my father a gold medal of honour for his having introduced artesian wells into Wirtemberg

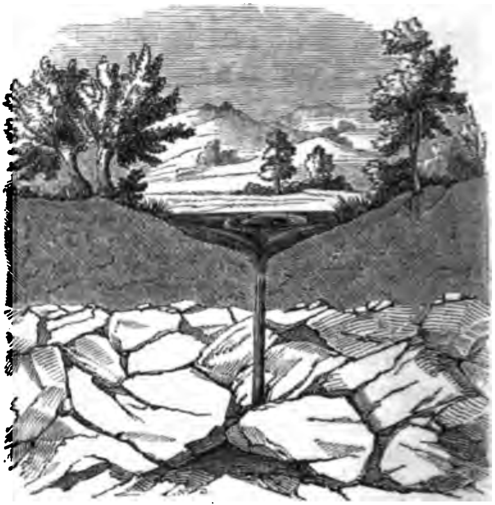
As to what, up to this time, in England, has been done in regard to absorbing bored wells, or, rather, has not yet been done, and still remains to be done, I shall have an opportunity of speaking in the course of this paper.

Experience has taught us, in establishing artesian wells in all countries and geological formations, that frequently positive and negative strata, that is, such as supply and such as absorb water, alternate with each other, a phenomenon which, if we proceed in a proper manner, involves the necessity of shutting off the latter with strong waterproof tubes, in order to permit the rising of a bored spring above the surface of the soil, or, at least, to avoid considerable loss of water. This we have already, on the evidence of our own experience, expressed in the first edition of our above quoted work in the year 1833, page 181.

In the muschelkalk formation, for example, where positive and negative strata occur alternately and irregularly, it is seldom possible to succeed in completing a rising spring-well without such an enclosure.*

Thus, if nature generally presents these positive and negative phenomena in conjunction with each other, it is obvious that the establishment of absorbing bored wells cannot be very limited. It has been reserved for modern times to develope this important object, and to give it, when placed in proper hands, practical importance in everyday life. Up to the present time, very little has been performed in this way.

Negative artesian wells admit, in respect of the removal of injurious waters, of numerous applications and combinations, as well as others, of which we shall shortly speak, and which reflecting minds will find out. The woodcut in the next column, for instance, represents the ideal section of a lake or a swamp which is to be drained, or the water drawn off, in order to obtain fertile soil for culture, or to remove stagnant waters, which now create and diffuse a noxious atmosphere detrimental to health. We suppose the upper deposit of the ground, whatever its thickness may be, as impervious to water, consisting, for example, of potter's clay, or clay marl, which retains the water, but under it an irregularly fissured deposit (say limestone or sandstone), the veins or cavities of which communicate with deeper lying springs, a lake, a river, the sea, or a slope of a hill, even if the distance should be a considerable one. Now, if the upper compact bed, which in nature may offer an alternation of different strata, is perforated, and the hole in the lower situated deposit carried down to a ramified cleft or cavern, then the immediate consequence of this operation must be, that the water of the lake or swamp rushes down in the bore-hole, is carried away, and the latter will be drained sooner or later, according to the capacity of absorption of the cleft and the diameter of the bore-hole.



I give this for the present as a simple ideal example, for I shall soon speak of realities, but whilst on this point, I am naturally led to the question, whether the same means might not be applied to the drainage of the Kopaës or Tobol Lake, in Greece, discussed by Fiedler,* in the district where, in ancient times, there flourished twelve rich villages, with half a million of inhabitants, but now the abode of millions of frogs and fish, with swamps full of reeds and sedges—if a certain number of bore-holes, about a foot in diameter, were carried down in the fissured hard chalk of that district? This can only be determined by fresh researches, to be made on the spot for this purpose.

In the construction of negative artesian wells we shall not always in boring meet with fissures. We shall often meet with subterraneous currents of water of a certain sectional height, partly filled with sand and pebbles, &c., which engulph and carry away the waters to be drawn off. Moreover, as artesian wells, executed in fletz-formations, for the most part represent *piezometers*,† we shall observe on the shores of the sea, where positive artesian wells during the flood furnish more water than during the ebb,‡ the opposite phenomenon, that is to say, we shall observe that absorbing bored wells are able to take in and carry off a smaller quantity of water during the flood, and a larger quantity during the ebb, because the flood produces a greater hydrostatic pressure upon the water-strata discharging into the sea than the ebb.

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* "Muschelkalk," corresponding to "shelly-limestone;" *French*, calcaire coquiller, calcaire horizontal.

* Reise durch alle Theile des Konigreichs Griechenland in Auftrag der Konigl. Griechischen Regierung in den Jahren, 1834 bis 1837. Von Dr. Karl Gustav Fiedler, Konigl. Sachs. Berg. Commissar, &c. Erster Theil, Mit sechs lith. Ansichten. Leipzig, Friedrich Fleischer, 1840.—Page 100 and so on.

† Compare: Theorie der artesischen Brunnen, nebst einer vollstandigen Anleitung zur Nutzanwendung dieser Brunnen in der Gewerben und der Landwirthschaft; von I. B. Viollet. Deutsche-Ausgabe, vermehrt mit fortlaufenden kritischen, Zusetzen und Erlauterungen nach eigenen vielfaltigen Beobachtungen und Erfahrungen von Dr. A. E. Bruckmann. Mit sieben Steintafeln und zwei Tabellen. Ulm, 1842. Wagnersche Verlagsbuchhandlung und Buchruckerei (J. A. Walter.)

‡ M. Baillet has described the influence which the flood exerts on the fountain at Royelle-sur-mer, in France; see "Bulletin de la Société d'Encouragement pour l'Industrie Nationale à Paris," 1822, p. 175; and also, M. Arago's account "De l'Effet des Marées sur quelques Fontaines Artésiennes" in the "Annuaire" for the year 1855, pp. 231–233.

Even strata of sand, gravel, sandy marl, &c., possess in many cases sufficient capacity of absorption to receive and carry off the waters led into them by means of bores, provided that their ends, as in all negative strata, crop out either on or near distant slopes or ravines, or discharge the water into lower situated caves, seas, lakes, rivers, springs, &c., or, at least, communicate with the latter in some way, although perhaps very complicated.

In both my new undertakings, specially described in the second division of this paper, I have met with, first a subterraneous current of water between the upper fresh-water formation and Jura lime-stone; secondly, a sandy clay marl in the upper fresh-water formation itself; and the intended purpose of the water-absorption was obtained in the first case perfectly, but in the second, as a provisional arrangement, at least sufficiently.

It is not too bold a proposition to maintain that negative artesian wells may be established in all the so-called normal or sediment formations—*diluvium*, the *tertiary deposits* (pliocene, miocene, and eocene), the *chalk formation* (as *e.g.* chalk and chalk marl, upper green sand and gault, lower green sand or neocomien), the *Jurassic rocks* (Weald clay, Hastings sand and Purbeck beds, Portland oolite and sand and Kimmeridge clay, coral rag and calcareous grit, Oxford clay, and Kelloway rock, great oolite, Stonesfield slate, fullers' earth and inferior oolite, and the black jura or the strata of lias), the *trias* (red marls and keuper sandstone, gypsum, muschelkalk or shelly limestone, and new red sandstone), the *Permian system* (magnesian limestone, or zechstein, lower red sandstone or rothliegendes, &c), the *carboniferous deposits* (coal-fields or measures, millstone grit with coal, carboniferous limestone with coal, sandstone, &c.), the *Devonian or old red rocks* (old red conglomerate, cornstone, sandstone, and marls, and Devonshire limestone and slate), the *Upper and lower Silurian deposits* (Ludlow rocks, Wenlock limestone, Caradoc sandstone, Llandilo flags and Cambrian slates), *Cumbrian slaty or primary rocks* (slaty greywacke, chlorite and mica slate, and Longmynd, Skiddaw, &c.), nay, under certain conditions, even the *igneous rocks* (granite, &c., basalt, greenstone, porphyry, serpentine, syenite, &c.[*]), for, *in all these formations currents of water move in a negative and positive direction, all are more or less fissured, and partly contain cavities extensively ramified.* Either they are fissured by the contraction of their masses, which were liquid in former times, or they are fractured[†] in various directions in consequence of disturbing forces which have acted upon them.

The localities for the purposes in question are not everywhere equally favourable, therefore, every practical execution should be preceded by a careful geological and hydrographical examination of the ground in question, and, therefore, in all cases a skilful and conscientious engineer only should be entrusted with such a research. It may happen sometimes, and has already happened in France, that, in establishing absorbing bored wells for the purpose of carrying off foul and noxious fluids, it has been necessary to go down to a much greater depth than that of the upper water strata, in order that neighbouring wells might not be infected by such new works. For the inside lining of such negative artesian wells cast-iron tubes have been recommended, in order that all contact of the fluids with the different strata through which they pass may be prevented, and A. Chevalier, to whose treatise we shall return, proposed to dip those tubes, before their application, into melted fat, and afterwards to cover them with a layer of tar.

In reference to the capacity of absorption of the different geological formations, I could enumerate a number of striking examples, but in order to avoid prolixity, I shall here quote only a few convincing facts. A geologist cannot be ignorant of such phenomena, and an unprofessional man may obtain a further information in good geological works.[*]

The *molasse*, a recent sandstone, in Germany and Switzerland, belonging partly to the pliocene, partly to the miocene deposit, is sometimes fissured in a high degree. It is a fact that, in this formation, negative strata have already been bored, *e.g.*, near Bodman, on the lake of Constance.

We find many other things in "Walchner's Manual of Geology" relating to this subject.

"In England and France, there is the upper *chalk formation*, much fissured, and often penetrated by fissures miles in length. Snow and rain waters soon sink there, and break out abundantly again at the bottom of the chalk mountains as springs. This may be seen in a remarkable manner at the lower part of the steep slope of the chalky Cap Blanc-nez, where powerful jets of water rush forth out of the clefts of the calcareous rock. The Mole, in the county of Surrey, in England, falls into a chalk chasm, and flows on in a subterraneous channel for two miles. But, above all such phenomena, the most noteworthy is the disappearance of the Rhône (Perte du Rhône, in France), which, near Fort Ecluse, rushes down into a chalk chasm, and flows on for sixty paces underground.

"The cleft constitution of the upper chalk formation can be made available for drawing off superfluous water, which, prevented from sinking down by clay strata, accumulates on the surface of the soil, and gives rise to the formation of marshes. By the removal of such stagnant waters, great service is often rendered to agriculture. The drainage of the plain of Paluns, near Marseilles, brought about by King Réné,[†] gives an example of this kind. That plain, now covered with the finest vineyards, was formerly a large marshy basin, without any outlet. Great sink-holes were carried down to the subjacent cleft chalk limestone, connected by ditches; in this way the whole basin was drained. The drained waters run through subterraneous channels to the port of Mion, near Cassis, where they come forth again in the form of springs."

In the region of the cleft hard chalk-stone, in the environs of Marseilles, we look in vain for springs. Marseilles fetches the water for irrigating the environs (*pour arroser les environs*) from the Durance, a distance of thirty leagues. Through almost the whole of Provence this scarcity of water may be observed, as far as the chalk formation is represented there by a hard fissured limestone; the waters sink down. The same is to be found in many parts of Greece, where the fissured chalkstone exists to a considerable extent.

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[*] Any one wishing to obtain a general view of the geological formations of England, may consult:—1. Geological Map of England and Wales, published under the superintendence of the Society for the Diffusion of Useful Knowledge; arranged by Sir Roderick Impey Murchison, G.C.S., F.R.S., Pres. British Association for the Advancement of Science, F.G.S., &c., &c.; London: George Cox, January 1st, 1853. 2. Tabular View of Characteristic British Fossils, stratigrafically arranged; published by the Society for Promoting Christian Knowledge, 77, Great Queen-street, 4, Royal Exchange, and 16, Hanover-street, Hanover-square, Aug. 1853. 3. As for the "Strata of England and Wales in reference to their Springs." see p. 90, &c., in "Rudimentary treatise of Well Digging, Boring, and Pump-work" (with illustrations); by John Geo. Swindell, R.I.B.A. Associate. Third edition; revised by G. R. Burnell, C.E. London: John Weale, Architectural Library, 59, High Holborn, 1854. Also, in Mr. Dempsey's "Rudimentary Treatise on the Drainage of Towns and Buildings" (London, Weale, 1854), p. 72 (Supply of Water), some accounts on this subject are to be found.

[†] Such a fracture or dislocation is geologically termed a "fault."

[*] In my German original edition, I especially recommended to Germans the geological works of von Leonhard, at Heidelberg, and Walchner, at Carlsruhe; but England has also an excellent literature in this department, as *e.g.* the works of Lyell, Murchison, &c.

[†] Also mentioned by M. Arago, in the "Annuaire" for the year 1835, p. 244.

A similar phenomenon is to be met with on the Karst mountain, near Trieste, and far down in Dalmatia. On the whole area of the Karst mountain there are many *subterraneous* waters known, which continue their subterraneous current through fissures and caves communicating with one another. Exactly the same appearance is to be observed in the environs of Adelsberg, in Carniola.

The remarkable peculiarities of the lake of Cirknitz,[*] which is to be considered as the true key to the knowledge of all configuration of ground, and of all movements of waters in the Julian, Carniolian, and Dinarian Alps, lead us also to instructive meditations on our subject. This lake has caves which supply, as well as absorb water, called, in Slavonic, "Jama Wondaja," "discharging doors," and "Jama Poshira," "engulfing doors."

The *coral rag*, as is well known, permits the waters to fall through almost everywhere; if we direct our attention to the Swabian Alps, we there see a little brook disappear in a cleft of the coral rag in the valley of Amterhausen, not far from Immendingen on the Danube. Upon the subsidence of the waters in that rock, I shall communicate some other examples in the second division of this paper, the results of my own observations, but I must cite here a few interesting facts described by Walchner in his geological work :—

"The general want of water on the plateaus of the upper jurassic limestone (coral rag), is a natural consequence of the numerous clefts and caves in these rocks, just as on the elevated plains of the Swabian Alps, which may be taken as an example. The atmospheric waters there sink quickly down, run off in the interior of the rocks in subterraneous channels, accumulate sometimes in large basins, often in known caves, which serve as reservoirs, and break out at the bottom of the mountains here and there with extraordinary force. It is surprising to see the crystal spring of the rivulet Aach, near the little town of Aach in the Hegau, which runs out of the white coral rag with such force that it sets mill-works in motion a few paces from its source; or the powerful spring near Urspring, in the rocky valley of Blaubeuren, flowing off at once as the Aachbach, and turning mills. Therefore, the valleys are always supplied with water, often in abundance, while the heights are in want of it. The temperature of the springs which come out of the deeper caves or break forth in the ground of the valleys, is throughout somewhat higher than the mean temperature of the place which indicates their ascent from a depth. But their waters, generally, contain but few salts, and no gypsum and no muriate of soda."

As for the Aach-spring, near the little town of Aach, its communication with the Danube seems to be placed beyond all question; Walchner gives on this matter the following notice in his smaller geological work which he has written for Oken's Natural History :—

"In the environs of Immendingen, near Donaueschingen, a considerable quantity of water from the Danube sinks down through clefts. This water flows out again near the little town of Aach, in a deep basin of rock out of clefts of the coral rag and in the form of a large brook, at once turning mill-wheels."

I myself had the opportunity of observing this interesting phenomenon on the spot; Walchner, however, who examined the conditions of it long ago, was kind enough lately to communicate to me the following results of his own research.

1. The miller at Immendingen stops, as much as he can, the holes and the clefts in the bed of the Danube above Immendingen, as without doing so his machinery would not have water enough when the river is low.

2. If the Danube after a thunder-shower in the valley of the Danube, becomes disturbed and muddy, some hours afterwards the Aach spring wells forth disturbed, and plainly shows the people dwelling near, and where there was no thunder-storm, that one has fallen in the valley of the Danube.

The difference of elevation between the Danube near Immendingen and the source of the Aach, near the little town of Aach, is—

Danube near Immendingen	2,190	feet (Badisch.)
Aach-spring	1,597	„ „
Difference	593	„ „

The two points are nine (English) miles apart.

The *keuper-sandstone* is sometimes deeply fissured; once I bored in the upper region of it, 81-feet deep; I found an absorbent stratum, instead of spring-water; this happened at the early period of my practice, in the year 1833, at Eisenlautern, beneath Löwenstein, in the kingdom of Wirtemberg.

I have already intimated the existence of negative and positive strata in the *muschelkalk* (shelly limestone); the numerous borings undertaken in this formation in Germany for brine and rock-salt have sufficiently proved it; the formation shows considerable disruptions, especially where it has undergone elevations. In the district of Durlach, in the Grand Duchy of Baden, and between this place and Pforzheim, the upper metalliferous muschelkalk is fissured so much that the waters sink, through the crevices, *e.g.*, at Einsingen, Bauschlott, Göbrichen, Stein.

The *new red sandstone* permits all waters sink where its upper laminated and slaty deposit is not covered with the red and variegated marls. Many communities situated upon this laminated sandstone, have no flowing wells in their villages, but only cisterns. The village of Stupferich, not far from Durlach, is situated in a flat basin of this upper division of new red sandstone. Thunder-showers pour considerable masses of water into the bottom of the basin by which the property of the inhabitants of the village is injured; at present they remove the injurious effect of such floods by sinking little shafts before their houses. When the water falls, it flows into these shafts, and runs down without doing any damage.

In the same way I might extend these remarks, and show that all other geological formations and their several strata have many disruptions, and partly ramified cavities, and, therefore, possess a capacity of absorption such as we require for our theoretical considerations and practical purposes; but the observations I have already made may suffice, especially as I have already referred to geological works. As for the rest, those who understand German, may read the notices of the *artesian wells* in Wirtemberg, given by Professor Plieninger at Stuttgart, in the "Correspondenzblatt des Königlich Württembergischen Landwirthshaftlichen Vereins," between the years 1830 and 1820; they will find there the description of the accidental or unexpected discovery of several striking absorbent strata, obtained by perforations for positive artesians wells in different beds."[*]

(*To be continued.*)

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[*] See Reisen im Sudostlichen Deutschland, von J. G. Kohl Zweiter Band. Leipsig, Friedrich Fleischer, 1852, page 325, &c.; and the "Annuaire" for the year 1835 (Paris, 1834) "Notices ientifiques," par M. Arago, pp. 210-213.

Compare also M. Arago's account in the "Annuaire" for the year 1835, pp. 214—222: "Il y a, meme dans des pays plats, des cavites souterraines dans lesquelles des rivieres s'engouffrent tout entieres."

A METHOD OF PRESERVING WOOD.

BY PROFESSOR DR. APELT OF SAXONY.

(*Translation.*)

The problem of preserving wood has become of great importance, nay, of public interest, by the construction of railways, now forming a large part of our national wealth. Numberless timbers from our forests form the foundation of railways, and are exposed to the influence of the weather and to every change of temperature. The powers of both the atmosphere and the soil are continually destroying his wood. The *daily* loss caused by the rot of sleepers on the Saxon railway lines alone is calculated at 550 dollars (about £185), which would constitute a yearly sum of 200,000 dollars (about £66,700). This present large consumption of wood, with an increasing population and increasing industry will, by degrees, surpass the production of wood, and thus the question arises, how long our forests may satisfy such wants if they are not lessened.

In order to meet that danger and to lessen the expenditure caused by a frequent restoration of the sleepers, several trials have already been made for giving the sleepers a longer duration by some artificial processes. These processes, for the most part, consist in impregnating the wood with metallic salts, such as sulphate of iron or zinc. The different methods employed therein are similar, as far as saturating the sleepers with the salt, but they differ chiefly in this respect, that, according to one system, the sleepers are placed in the solution of metallic salt for a short time only, and at a high temperature, whilst, according to the other system, the sleepers are placed in the solution at a common temperature, but for a longer period. These methods require certain more or less expensive apparatus and hand-labour. Besides, the sleepers have to be conveyed twice over the same ground; those that have not been prepared must be carried to the impregnating apparatus, and, when impregnated, have to be taken away again. Moreover, every method involving the above principle is open to many objections, viz.:—

1. It at present offers no safe guarantee for the future. All these methods are yet of too recent a date, and can present no reliable results for many years. The expected success is, therefore, merely hypothetical, being in no way guaranteed by experience.

2. Even the expected success may be much doubted. Inspection of the sleepers saturated with the hot solution shows that this process has only caused the sapwood or external covering to be impregnated; the heart itself of the wood remains untouched. Now, since the wood of the pine tree usually rots from the inside to the outside, and not, like the oak timber, from the outside to the inside, that method would be objectionable when applied to the pine timber. Besides, the great heat to which the sleepers are exposed in that process, might easily injure the strength of the wood, since the resinous particles are made fluid thereby and withdrawn from the wood. It is true that the metallic salt penetrates more deeply into those sleepers which are placed in a salt solution for a longer period without being boiled, and the more so the longer that period is extended. But another objection may be raised against the expediency of that method, as well as of the boiling process. The impregnation of wood with a metallic salt is only a means to attain a particular object, *i.e.*, the preservation of the wood, which can only be attained if the mineralisation of wood is effected. The process of mineralisation, like the process of petrification of wood, consists of two parts, the first action takes place with the *impregnation*, the second with a slow and gradual *removal* of the organic parts. In the case of a petrifying process, nature introduces, *constantly* and *continually*, the silicates, and, in case of a mineralising process, the metals, which take the place of the organic parts. Quite the reverse takes place with impregnated sleepers. Humidity extracts the substances again, and thus nature withdraws from the wood the metals which have been introduced into it artificially, long before they have completed the slowly progressing mineralisation.

3. All methods of artificial impregnation have the essential defect of being neither applicable to telegraph poles nor to buildings. Now, although no such capital is invested in them as in sleepers, yet their frequent falling down causes great inconveniences in the working of the line.

The rotting of the woody fibre arises generally from its being composed, like all organic bodies, of three basic substances (carbon, hydrogen, and azote), and of comparatively too small a quantity of oxygen for counterbalancing chemically those bases. Therefore, as soon as the vital power of the organic body is extinguished, and the changes going on under its influence cease, those basic substances follow their chemical affinity, saturating themselves with oxygen, partly volatilising in a gaseous shape, and thus producing the gradual destruction of the organic body. Notwithstanding this great tendency of organic bodies to destruction, we find in fossil plants vegetable remains of the remotest antiquity, which nature has preserved for thousands of years without altering their external form or internal structure. The chemical composition alone of the cell of the plant has been altered, organic substances having been substituted by inorganic substances. This process of petrification and mineralisation is, as it were, a hint from nature what direction to take for solving the problem of preserving wood.

I have now succeeded in finding out a mode of preserving wood which harmonises with that leading idea, and which rests upon a different principle from that on which all methods hitherto known are based. Its success is not merely hypothetical, but is founded on an experience of many years. Having been enabled, through mining pursuits, to collect experimental facts on that subject, I can now produce samples of wood which have been for more than 15 years subjected to the process.

1st. The wood is rose-coloured in the inside, and particularly so in the heart, pine wood still more so than any other wood. When consumed it produces red ashes. This red colour of the wood, as well as of the ashes, originates, as will be shown by the following explanation, in the oxides of iron with which the wood has been imbued. 2nd. The wood cleaves well and clear. 3rd. It does not tear crosswise. 4th. It preserves the power of holding nails. 5th. The annual rings of the wood are not severed. 6th. It still splits. 7th. It allows itself to be bent without breaking.

The method which I have adopted for preserving this wood is new and original, not only respecting the *means* which I use, but also respecting the *principle* on which the whole process rests.

I use the so-called sulphureous coal of Oppelsdorf, a peculiar coal, which is not to be found elsewhere, and which consists of finely-divided marcassite ($Fe\,S^2$, $Fe\,S$) for about two-thirds of its weight. This coal has, as I have found, that remarkable peculiarity of preserving wood by a simple process, which chiefly consists in allowing the sulphuret of iron in the coal to change into sulphate of the protoxide of iron.

The *principle* on which my method rests, and by which it is chiefly distinguished from all others, consists in operating without any apparatus and without any expense for labour, simply using the process of *nature*, which gradually mineralises the wood, and removes the injurious influence of the soil. It is, therefore, the simplest and also the least expensive method that can be devised. The plan of working is as follows:—

The sulphureous coal of Oppelsdorf having been changed into "vitriolic" coal, is brought into *immediate contact* with the wood about to be preserved, whilst the coal, by its hygroscopic nature, attracts the humidity the atmosphere, and by its being exposed to the influe of rain, the sulphate of iron contained in the coal is dissolved, and penetrates slowly and gradually into the wood, and impregnates it. Thus the mere contact of the powers of *nature* achieves the process of impregnation with a metallic salt, which by any other method can only be performed by *art* and by the employing of certain fixed apparatus, and it is most remarkable that, according to this method, a power of nature, *i.e.*, humidity, is called upon to effect the preservation of the wood, which, under other circumstances, is the most injurious agent. But not only a *natural* impregnation is obtained thereby, but also the progressive mineralisation of wood, which is the chief point to be effected, a problem in *artificial* impregnation still unsolved. This may be proved theoretically as well as practically.

The rot is produced by the tannin of the wood, which has a great affinity for oxygen, uniting with oxygen, and thereby forming "ulmin," the so-called efflorescent ore (mulm). This oxygen is introduced into wood, which, like pine-timber, rots from the interior, much more by the humidity penetrating it than by the action of the atmosphere. Now, if the penetrating fluid contains a solution of sulphate of iron, the protoxide of iron, which is changed at the same time by combining with the oxygen into oxide of iron, unites with the tannin of the wood to form gallate and tannate of iron, whereby the formation of "ulmin" is prevented, and the rot rendered impossible.* In the year 1836, Professor Göppert, of Breslau, suggested, in a speech delivered in Jena, at the Society for Promoting Natural History, on the subject of petrification of plants (Isis, 1837, part 5, page 341), that in the process of petrification nature did not remove the organic parts by a high temperature, but gradually by a *wet process* through a quiet decay; and he founded his supposition upon the fact that by the forcible process adopted by him for changing plants of the present day into fossil ones, by putting them between red-hot clay plates, the wood had never acquired the solidity of the petrified wood. My own observations confirm his supposition, by adding a positive reason to the negative argument as adduced by him.

The condition of the wood preserved by me tends to show that the practice of my process is in perfect unison with theory. Thus this wood, unlike the artificially impregnated wood, does not contain the sulphate of iron in green deposits between the annual rings; on the contrary, the red colour of the wood, as well as of the ashes, proves that the soluble metallic salt has been decomposed, and the protoxide of iron changed into oxide of iron. Even in allowing this reddened wood to lie for days in water, the latter remains colourless; this being an evident proof that the oxide of iron has not merely been deposited in it *mechanically*, but that it has amalgamated *chemically* with the wood, *i.e.* that the wood is in a state of mineralisation.

Besides this peculiarity of the sulphureous coal of Oppelsdorf for preserving the wood, which rests upon the strong affinity of the iron contained in it with the tannin of the wood, the said coal possesses another remarkable quality. Besides the sulphuret of iron, it contains sometimes a small quantity of arsenate of iron, which, as is well known, by its *mere presence*, is one of the strongest preservatives against rot.. This power of the arsenate of iron of protecting the wood against the rot by its mere presence, rests upon the circumstance that it takes up the oxygen introduced into the wood by humidity (since $AsO^{1\frac{1}{2}}$ changes into $AsO^{2\frac{1}{2}}$), neutralising thereby the oxygen.

One peculiar advantage of my method over all others remains to be mentioned. Whilst the wood lies in the ground, two different causes, and quite independent of each other, co-operate in destroying it; the *internal* disposition of the woody fibre to decay is still augmented by the *external* influence of the power of vegetation of the soil. All methods hitherto employed for preserving wood act simply by resisting the decaying powers of the wood itself, whilst they are unable to remove those noxious external influences which are the main cause of injury. According to my method, a vitriolic substance is placed between the wood and the soil, which substance exerts its influence as well on the soil as on the wood, thereby entirely destroying the power of vegetation in the soil which injures the wood, and at the same time augmenting the power of the woody fibre to resist decay.

It is moreover evident that effects are more lasting the longer the cause continues to operate. Now, according to my method, the wood may be kept continually under the influence of a preserving means, whilst with every other method it is exposed only once to a transient influence. Notwithstanding the great simplicity of the principle on which my method is based, it nevertheless combines a variety of advantages. It differs, as I have already pointed out, in many respects from the other methods. Those differences may be summed up thus:—

1. I do not soak the sleepers in a vitriolic fluid, but I surround them with a solid vitriolic body.
2. According to my method, the impregnation of the wood is not effected by art, but by the powers of nature, which act without requiring any expenditure of human labour.
3. According to my method, a gradual process of mineralisation of the wood is begun and continued, the required material thereto being supplied by the continuous *natural* impregnation. In the *artificial* impregnation, on the contrary, a surplus of metallic salt is introduced at once into the wood, which (since it is not decomposed and again chemically continued in other forms) becomes dissolved by the penetrating fluid, whereby the required material for a gradual mineralisation is withdrawn from the wood.
4. Every other method operates only *in one way* upon the wood. My method produces a *double* effect—first, on the wood; next, on the ground on which it lies.
5. According to all other methods, the preserving agent operates on the wood only once, and in a quick, transient mode. According to my method, the agent operates slowly and continuously.
6. Every other method requires a fixed apparatus and the necessary capital for working it. My method may be applied anywhere, and to the sleepers that are already laid down.
7. It saves all the time required for the preparation which with other methods increases the expenses.
8. Lastly, it has the advantage of being not only applicable to railway sleepers, but also to telegraph poles and buildings.

Besides the cheapness and efficiency of my process, I shall only add that I thus render the influences of temperature not only harmless, but even serviceable to the preservation of the wood, and cause nature to perform that which in other processes involves large and complicated apparatus.

DECIMAL COINAGE.

On Wednesday evening, the 16th instant, at a meeting convened by the Decimal Association, and held in the large room of the Society of Arts, by permission of the Council, a lecture "On the Approaching Simplification of the Coinage" was delivered by Professor De Morgan; W. Brown, Esq., M.P., in the chair.

The lecturer commenced by some observations on the present state of the question. After enumerating the Scientific Commissions, the Report of the Committee of the House, the vote of the House, &c., &c., he stated that there is no longer any difference of opinion about the advantage of decimal reckoning, in all things whatsoever, except only one. The exception is time. With people in general this matters nothing, since they do not perform arithmetical operations on broken hours and minutes; the astronomer cannot alter his mode of reckoning, since he is obliged to keep himself in connexion with the whole history of his science for 2,000 years past.

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* This produces a decomposition of the metallic salt. The protoxide of iron is changed into oxide of iron, and penetrates in the cells in the shape of infinitely small crystals, imperceptible even under the microscope. This substitution causes the gradual agglomeration of these small crystals to take the original shape of the plant cells.

At and since the re-coinage of 1816, there had been a gradual disposition to seek for a decimal coinage. The plan called the pound and mil plan had been traced to an anonymous writer, signing "Mercater," in the *Pamphleteer* for 1814. But the lecturer stated that it had been communicated to him by Mr. Hendriks, only just before the lecture commenced, that Simon Stevinus himself, the inventor of decimal fractions, had distinctly recommended that each country should keep its own large coin, and had specified the pound sterling as that which England ought to decimalise.

The various systems which had been proposed had all sunk out of public notice but two, the *pound and mil* system and the *tenpenny* system. These terms were used in somewhat of a sarcastic sense, which was anything but a disadvantage, for nick-names fixed men's minds upon the peculiar points of a system. But then they must be correctly given. For instance, some opponents on the tenpenny side had called themselves Little-endians, and the pound and mil people Big-endians. They had got hold of the poker by the wrong end. Lemuel Gulliver, on whom all relied, except the Irish Bishop, who, when the voyage to Lilliput appeared, declared he did not believe half of it, stated that the Endian dispute arose out of the following dogma :—"True believers break their eggs at the convenient end." Now the pound and mil people believe that the small end was that at which the coinage ought to be broken, and a small crack of four per cent. in the copper served their purpose. But the real Big-endians—the tenpenny people—smashed the sovereign into tenpenny bits, making such a hole, the lecturer contended, as let out all the meat, in getting rid of the pound and shilling. Of the two systems now before the world, the pound and mil required, imperatively, nothing but a diminution of the copper by four per cent., so that the half shilling should contain 25 farthings—whether called farthings or mils,—instead of 24. This change being made, it would be impossible to calculate otherwise than decimally. The lecturer charged the pound and mil advocates with not being sufficiently alive to the distinction between the necessary and the contingent parts of their own plan. They dwelt too much on new coins and arrangements of coins, which were matters of convenience, not making sufficiently prominent, as a full attainment of the power of calculating decimally, the little alteration in the copper above noticed. On another point also he took his own side to task for a misconception of their true position. So long as they occupied the field alone, the little change which they proposed made them innovators and radicals, and they might be aptly compared to the old reformers, who pressed the removal of the franchise from Sarum to Manchester. But when proposals came into notice which involved an entire subversion of the existing coinage, they, the pound-and-mil people, became the conservatives, the tenpenny people and others putting the pound into schedule A, and the shilling into schedule B. This, the lecturer contended, was not sufficiently apparent even to the Decimal Association, which seemed content to be regarded as one innovating body among a number, without reference to its right to be considered the conservator of what exists, with the most simple of all possible proposals for decimalising. The tenpenny plan, which preserved the penny, and introduced a tenpenny coin—which the lecturer called a franc—proposed that the existing coinage should be allowed to continue until gradually absorbed by the Mint, so that, for ten years at least, the tenpence and the shilling would be circulating together. There being nearly 120 millions of shillings, no less time could be allowed. Old persons remembered that, in spite of the re-coinage of 1696, silver coins of Charles II. were in circulation in 1815. Independently of all considerations of convenience in other respects, the concurrent circulation of the shilling and the franc appeared to him practically impossible as matter of arithmetic. He believed, for his own part, that, at the outset, no such thing was intended. He imagined that their first plan was to recall all the existing shillings and sixpences, and to substitute tenpences, and that, when the immense magnitude of the operation came to be considered, the idea of allowing the concurrent circulation was substituted. He considered that both parties had dwelt too much on accounts and large transactions, and that neither party had sufficiently pressed the inquiry into the position of the poor man at the pay-table. For himself, he had had particular means of considering this question. As a mathematician, many writers had objected to his having a voice in the question. He instanced an advocate of the tenpence, who wrote to him in very flattering terms, pressing upon him the tenpenny system. He replied, giving his reasons for preferring the pound-and-mil. The other party rejoined with a regular reproof, asserting that mathematicians in their closets had no right to settle such questions, the writer forgetting that he himself had sought the correspondence and had found his own way to the mathematician's closet. This writer, and many others, had forgotten, or did not know, that he, the lecturer, was an actuary of five-and-twenty years' standing, as well as a mathematician, and had been pretty often brought into connexion with money affairs, to say nothing of his being a teacher of monetary arithmetic. But the lecturer thought he had a position which made him better able to judge than he could have been, either as a mathematician or as an actuary. He had been for twelve years a manager of a saving's bank, and in that capacity had had, scores upon scores of times, to receive or to pay out from two to three hundred pounds in a couple of hours, and in all kinds of sums, from a shilling and some halfpence upwards. When he looked at the bankers' clerk, with his luxurious counter and his convenient scoop, and all his other paraphernalia, he, at the pay table of the savings' bank, looked upon that same clerk as an aristocrat, who knew little of the difficulties of humble life. After describing all the entries which he had to make, and the difficulty of making the poorer classes understand the necessity of the common forms of business, he asked how all this work was to be done in two hours, if both parties had to combine mental arithmetic with counting before they could finish any transaction. Say a poor man came to withdraw 17s. 6d. in a mixed coinage of shillings and francs. Would it be required that two separate bowls should be provided, one to hold the old coinage and the other the new? He believed no man of business would hear of a scheme which required this. Would it be demanded that every payment should involve a casting up on paper? He thought this could not be listened to either. Well, then, it being supposed that shillings and francs were mixed in a bowl, suppose he took out in succession 4 shillings, 4 francs, 1 shilling, 2 francs, 1 shilling, 3 francs, 2 shillings, 2 francs, 3 shillings. Can any one in the room tell me, asked the lecturer, whether I have got beyond 17s. 6d. or not. He considered that any scheme was at once upset which required mental calculation in addition to counting. With reference to the pound and mil scheme, this sort of question never arose. The man received his 17s. 6d. as now, in the same coins, or perhaps with more florins than now. It might go down in his employer's books as 8fl. 75cts., but that was nothing to him. When he came to change a half-shilling, his rule would be to get a farthing *more change*. If he bought a threepenny loaf, he would know that he ought to get 3¼d. back instead of 3d. To those who had no books to keep, and no sums to do, this was all. The lecturer enforced the difference of the two systems as they affected those who could do no more than count, in various ways, and ended by hoping that some advocate of the tenpenny scheme would stand up and explain how the poor man, who was no calculator, except in merely knowing how to count, could be made to know he had got his 17s. 6d. in the mixed francs and shillings. He had previously said a few words on the international coinage, classing its supporters by implication with the tenpenny people, and explaining that the exchange would introduce the existing complexities of calculation, even though all nations had the same coinage. He expressed his belief that nothing could shake the pound, and that he was satisfied the only point was to prevent the tenpenny system from impeding that of the pound and mil. He no more expected a strong mercantile feeling against the pound than against the Habeas Corpus Act or the National Debt. In reference to the convenience of the different coins for alteration, the lecturer contended that the pound was to the rich, and the shilling to the poor, the coin of slower fluctuation. Ten pounds' worth of furniture might vary much in quantity and quality in the course of a dozen years; but it would not vary by starts. Wages, measured in shillings, might be nearly doubled or halved; but this would be a work of time, and unmarked by great sudden changes. But the pennyworth of goods sold for copper was one thing to-day and another thing to-morrow. A few showers of rain before harvest would very quickly make a difference of much more than 4 per cent. in the bread sold for threepence. So that, in fact, the poor man was really accustomed to rapid changes in the value of the copper. As to the robbery and spoliation, as it was termed, of taking a fraction of a farthing, for one occasion only, from one man, and giving it to another, the lecturer contended that every government had to do much harder things in the way of taxation, and that, in the present instance, the poor man would be repaid most amply by the simplification of money arithmetic, which would give his children a much better chance of rising into commercial employment.

The discussion announced in the programme was commenced by

Mr. **James Yates**, a prominent advocate of an international and uniform system of weights and measures, who spoke at some length. He spoke highly in favour of an international system; praised highly a proposal of the French government to that effect, at the time of the first French revolution; complained of the tone of the publications of the Decimal Society; and claimed for those whose views he advocated the merit of being more decimal than those who styled themselves decimalists by pre-eminence. Mr. Yates declared himself strongly in favour of a silver standard of value in preference to a gold one; and, as an argument in favour of introducing the franc, adverted with much force to the fact that prices current were universally quoted in shillings—that here in one of the main items of their accounts, the pound sterling was universally rejected by merchants of every grade throughout the kingdom. Mr. Yates complained of the international plan being confounded with the tenpenny system, with which it had nothing to do. He maintained the necessity of a smaller coin than the farthing, and produced some articles in common use for which smaller coins were wanted.

Lieut.-General Sir C. W. **Pasley** briefly replied to Mr. Yates, and explained that he considered the metrical system very far from perfect. General Pasley noted with particular exultation that the French had found it impracticable to issue more than one volume of their Nautical Almanack on the decimal system.

Mr. **Robert Dawbarn**, of Wisbeach, Cambridgeshire, made some brief but practical remarks, which were very favourably received by the audience. He adduced examples of easy calculation on the Belgian and American systems, and contrasted therewith the perpetual confusion of accounts that prevails in most of our colonies, but more particularly in Canada, where three or four conflicting currencies keep the trading population in a fever of perplexity.

Mr. J. A. **Franklin** replied to Mr. Yates; and, as regards an international coinage, laid much stress on the fact that the Belgian franc did not circulate in France; and that, though the French and Belgian francs were the same, there was a rate of exchange between the two countries; as well as that the Australian sovereign, though identical in weight, size, and appearance with our own, would not pass current in England at par.

A **Gentleman**, whose name we did not learn, insisted on international currency; and as a member of the International Association, denied that they had anything to do with the question of gold or silver standard. He then insisted on an old argument—namely, that the pound and mil scheme required three decimal places, whereas the franc and dollar schemes require only two.

It being understood that an adjournment would take place,

Professor **De Morgan**, in reply, said that the pound and mil men considered the international people as tenpenny people, because they preferred the French franc, which was 9½d. and a fraction; and they, the pound and mil people, did not stand on small fractions of farthings. If, however, the internationals proposed to withdraw all our silver at once, so that their francs should not circulate with shillings, he admitted that they must be met on different grounds. With reference to the necessity for smaller coins, he adverted to the known fact that government had tried to introduce the half-farthing, and had failed. As to the question of two or three decimal places, he reminded the meeting that franc and dollar nations were already used to *two* subdivisions of the leading coin, and so fell naturally into two decimal subdivisions; but that we, on the other hand, were equally used to *three* subdivisions—shilling, penny, and farthing—and should with equal ease, fall into the three decimal subdivisions of pound, cent. and mil.

Mr. **Robert Rowan Moore** moved, and Mr. T. A. **Walleys** seconded, an adjournment of the discussion, which was unanimously agreed to by the meeting; and, after a vote of thanks to the Chairman, the meeting separated, on the understanding that the discussion would be resumed either on the following Wednesday, or such other evening as the Society of Arts could conveniently spare the use of the room.

Home Correspondence.

EDUCATION OF GIRLS.

Sir,—That education should be based on religion there can be no doubt; but, as discussions on this subject are forbidden by the Society of Arts, nothing more is said of it in the following observations than that education should be such as to enable a child to do its duty in that station of life to which it has pleased God to call it.

Although the Dean of Hereford, that most able promoter of education, is averse to the plan of school nurseries, yet it can hardly be denied that in populous towns there must ever be many instances when mothers are *forced* to leave their infants to the care of others whilst they go out charing, or are otherwise employed in earning a livelihood.

It seems desirable that the pay for such infants should be equal to the expenses of food, &c.; for if the nursery be gratuitous, mothers might be induced to place their babies in them merely to get rid of the charge. And with a well-selected motherly matron, even little girls could be taught to take care of the infants, and thus the benefit would be twofold, by teaching them the management of children should they become mothers themselves. Amongst the many advantages obtained, they would learn the necessity of cleanliness, both in person and food, so essential to their well-being. Proper ventilation and means of taking exercise, such as the baby-jumper, should also be provided. And, of course, their mothers should at stated times be allowed to suckle their offspring, whose artificial food should never be permitted to get sour, as that is the most injurious and frequent source of illness in the poorer classes. Habits of order cannot be too early inculcated, especially not wilfully to destroy things, which infants are too apt to do. And, lastly, it may be observed, that a mere baby may be taught to join its little hands in prayer, even when it cannot yet articulate the words.

It is a general defect in schools for girls that they are not taught what is most useful to fit them for service, or to become good wives or mothers. Even when not strong enough to scour, they might early be taught to sweep and dust carefully. The school-rooms, both boys' and girls', would afford an opportunity of doing so, and the cleaning the church might be done by the most deserving and careful.

I am, Sir, your's truly,
M. S. BENTHAM.

SOLID INK.

SIR,—Some time since I tried an experiment to make a solid ink (to be used in a case) with Frankfort black (manufactured from the cuttings of the grape vine) and linseed oil. I succeeded in making it indelible, so that it would not rub off, but I could not make it sufficiently firm. Being informed there has been an oil extracted from tobacco, more drying than any previously known, it suggested the idea that it may prove the needed requisite; or probably some of your numerous readers may succeed in accomplishing that which I believe could be made a source of incalculable wealth, and to the million a friend, to supersede the pen and blotting paper.

I am, Sir, &c.,
G. N. SHORE.

Lyme Regis, 16th July, 1856.

ANALYSES OF THE IRON ORES OF GREAT BRITAIN.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF HER MAJESTY'S TREASURY.

SIR,—I cannot resist expressing the satisfaction I feel at this publication of the first steps of a great national work now undertaken by the Jermyn-street establishment. It is now more than 50 years since my father, with an ardent zeal, indicated such a comprehensive series of analyses as one of the most valuable scientific enterprises which the intelligence of this country could achieve. Through a long and active life he continued always to look forward to a period when he might have leisure to place the iron manufacture of his country on a firm and extended basis, by the chemical investigation of all the materials employed in it. But in truth the task is too great for any one man to accomplish, even with the devotion to it of his whole time. It is the fit undertaking for the united efforts of a public institution, and if this government school proceeds with vigour in prosecuting the work thus happily commenced, its teachers will indeed produce an intrinsic exchangeable value for the large yearly votes of public money accorded to them. I would strongly recommend that the series of analyses should be made at once complete, and that with every specimen of iron ore, the coal and fluxes used in smelting it should be also analysed, and the whole results be tabulated together. This would render every step of progress complete in se, and the performance would be more easy, more satisfactory and interesting, when accompanying the iron ores, than by postponement to some remote period. The analyses of the whole of the iron-making coals of Great Britain, published in 1840, in my father's papers on "Iron and Steel," is the most comprehensive work of the kind ever executed by an individual, and, as is well known, furnished the hint and the basis for the experiments which Sir H. de la Beche subsequently superintended for government. But these do not proceed to chemical detail, in its immense minutiæ; they give merely the carbon, the earth, and the volatile matter by dry distillation. The chemical composition of the ashes and of the gaseous contents of the coal, are the proper work for a great chemical school, and, added to the analyses of the flux employed with each specimen of ore, will complete the scientific and practical value of the publication. Dr. Percy very truly remarks in his preface, that the value of the analytical investigation would be greatly enhanced by a corresponding investigation of the iron produced, and with equal correctness he indicates the great skill and persevering labour which such a work would require. Carried to its full extent it would, indeed, be a task as vast in its toil as in its benefits, and demand a rare union of comprehensive practical and scientific acumen and industry. But a beginning, and a sure foundation, will at least be made by recording a complete series of the composition of the raw materials, ready for some master mind to examine and classify in reference to the metallic produce. And, as preparatory to this, it would be well to lose no time in accumulating specimens of both the cast-iron and the bar-iron, before time leads to any change in the use of the united materials. Some singular facts appear on comparison of the results printed now in part first. For instance, the very large proportion of organic matter in the ironstone which yields the high quality Lowmoor iron is suggestive of the valuable effects formerly attributed to animal charcoal in steel-making and other processes of iron manufacture. I am a little surprised to notice the absence of any traces of lead in the specimens of Weardale ore. This ore, from Stanhope and Towlaw works, is the matrix of the lead veins of that district; and a speculation for smelting extensively, at great profit, the vast accumulated spoil heaps of the ancient lead mines, which led to the erection of these ironworks, was materially impeded and impaired by the rapid destruction which the combined lead on these matrices effected on the interior of the furnaces, and I should have expected this metal to be prominent in the analyses. Soon afterwards, the discovery of the very different deposit of ore commenced, at Consett, the present great extension of the iron manufacture of Durham and North Yorkshire. I can only say to Dr. Percy, go on and prosper, for, as was so generally pointed out in the discussion on Mr. S. K. Blackwell's paper read at your meetings in December and January last, the search after quality is not the ruling consideration in the private mind of the British ironmaster, and, therefore, there is the more reason why public institutions should take up, as a public question, researches for the national benefit into the causes of superior quality, from which all who choose may profit. To re-quote the important quotation, concluding Dr. Percy's preface, "the manufacture of iron is the basis and index of modern civilisation, and every effort tending to improve it is a matter of general welfare." A text of which the truth and the importance are alike undeniable, and suggestive of infinite topics of remark, but I have now trespassed sufficiently on your space, and shall beg to forward for your next number some further observations on this important publication by the expressed authority of the Lords Commissioners of her Majesty's Treasury.

I am, &c.,
DAVID MUSHET.

July 21st, 1856.

Proceedings of Institutions.

◆

Radway (near Banbury).—On Wednesday, the 9th, was held the annual general meeting and rural *fête* of the Mechanics' Institution. The members met at the Institution at three o'clock, to transact business, elect officers, &c.; afterwards they proceeded through the village to Ivy-lodge, where, by the kind permission of the owner, about 130 members and friends sat down to tea in the grounds. Racing, jumping, and other rural amusements followed, and at seven the party adjourned to the school-room, to hold the evening meeting. Mr. George Miller, the Vice-President, took the chair, and opened the proceedings. The meeting was afterwards addressed by the Revs. W. S. Miller, C. D. Francis, and E. R. Johnson, and by Mr. Shephard, of the Coventry Mechanics' Institution. At the close of the meeting, dancing commenced. During the past half-year, this Society has much improved; the evening attendance has been very good, and a greater number of books has been taken from the library than in any half-year before, and these have been of a higher stamp than heretofore. The number of books taken from the library was 602; of periodicals, 125; in all, 727; giving an average of 8·55 to each member.

Royston.—On Tuesday, 15th inst., Dr. Charles Steggall, Trinity College, Cambridge, delivered a lecture, for the benefit of the building fund of the Royston Mechanics' Institute, on the Chamber Music of England in the 18th and 19th centuries. Dr. Steggall commenced with a brief epitome of his former lecture on chamber music down to the time of Purcell, on whose extraordinary works he made some additional comments. Dean Aldrich and Dr. Tudway received their share of attention. Handel's life and mighty genius were warmly dilated on; and after some brief remarks on the works of Dr. Green, Dr. Boyce, Dr. Arne, S. Webbe, and Dr. Calcott, the productions of Sir Henry Bishop were highly commended. The lecturer spoke of the extraordinary influence of the church over the music of the country; he lamented that the Reformation, fraught though it was with blessings, seriously impeded the progress of the Fine Arts; he offered a tribute of praise to Mr. Hullah for his efforts to improve the taste of the people; and he alluded to one of his countrymen, Professor Sterndale Bennett, who had rendered eminent service to music. In conclusion, Dr. Steggall took a hopeful view of the prospects of music in this country. Master Stainer, Messrs. Barnby, Cummings, and Howe, from London, assisted in the vocal illustrations. Professor Sterndale Bennett assisted in the illustrations by playing a selection from Handel's harpsichord lessons on the pianoforte, and the accompaniment to Handel's chorus, "Galatea, dry thy tears." The professor's performances were listened to with the deepest attention. At the conclusion, a vote of thanks to Dr. Steggall and Professor Bennett was unanimously carried, on the motion of Mr. John Phillips, seconded by Mr. F. N. Fordham. Dr. Steggall returned thanks on behalf of the professor and himself.

Wirksworth.—A *fête*, in connection with the Wirksworth Mechanics' Institution, took place on Thursday, the 26th ultimo. The Institution is now in the fourth year of its existence, and it has overcome the difficulties attendant upon its establishment, and is steadily increasing in usefulness and importance. It was at first intended that only an exhibition of mineral specimens, paintings, &c., should be held; but as the president (W. Cantrell, Esq.) kindly placed his grounds at the disposal of the committee, it was thought that a step further than an exhibition might be attempted, and hence the resolve to hold a festival. A committee of ladies, in conjunction with the committee of the Institution was organised, for the purpose of making the necessary arrangements for the tea to be furnished on the occasion, and through their exertions sixty trays (the gift of the ladies of Wirksworth) were placed at the disposal of the committee. About noon most of the shops were closed, and the inhabitants wended their way to the president's house, in the vale of Wirksworth. Two telescopes, which stood on the lawn, were in full requisition all the day. In the house was displayed the collection of mineral specimens, paintings, and works of art, gathered from around Wirksworth. In the first room were a "Cattle Scene," Portrait, by Rawlinson, belonging to W. Cantrell, Esq. "The Chase, Melbourn," belonging to Mr. Swift, Derby. Portrait, by Wright, R.A., "Old Market Cart." Scene, by Rawlinson, belonging to W. Wright, Esq., "The Jealous Husband." Head, by Spagnoletto. "Market Scene" (a very remarkable Dutch picture); Portrait, said to be of Nell Gwynne; and an Ice Scene, all belonging to the Rev. J. Edwards. Portrait, by Romney, R.A., and "Bacchante," by Romney, belonging to the Rev. R. M. Jones. "Scene in the Garden of Buckingham Palace," by Vawser, jun.; "Welsh Scene," by Barker, jun., Bath; "Scene," by Vawser, jun.;" and "Scene after Wouvermann," belonging to the Rev. J. Edwards. "Old Dutch Scene," also a large painting, supposed to be by Titian, belonging to W. Wright, Esq. "News!" Old man reading paper over door, belonging to W. Cantrell, Esq. Mineral Specimens:—Case of mineral specimens, belonging to T. Poyser, Esq. Case containing old coins. Minerals. Portion of ancient miner's spade, ancient miner's pick, and other tools. Case of mineral specimens. Large stalactite. Fossil back-bone of icthyosaurus, belonging to A. Harward, Esq. Collection of mineral specimens of W. Cantrell, Esq. Case of birds, belonging to T. Poyser, Esq. Case of insects. Puzzle, from the island of St. Domingo. Apparatus illustrating Foucault's pendulum proof of the rotation of the earth. Case of Indian work. Model of palanquin, and costumes of Madeira. Chinese shoes—woman's size. Indian toad, &c. A Boscobel box, silver mounted, with King Charles in the oak-tree. In passage or entrance-hall:—Sketch, by Miller, "Death of Amelia," from Thomson's "Seasons," after Wilson; "Burgomaster and Daughter," by Stephanoff; "Rabbit Shooting," by Huskisson, all belonging to the Rev. J. Edwards. Portrait of Whitehurst, the geometrician, by Rawlinson; "Dove Dale," by Wright, R.A.: and Portrait of Dr. Darwin, belonging to T. Poyser, Esq. Curious engraving of head of Christ in one line, beginning at nose. Engraving of "Crucifixion," from Van Dyke. Engravings of "A Fine Old English Gentleman" (the late F. Hurst, Esq., and J. Strutt, Esq.) Sketch of two well-known Wirksworth characters (Jemmy Tinsley and John Ludlam), by a Wirksworth lady. Microscopes, &c. Second room:—Two very amusing engravings, "Musical Bore," and "Time and Tide wait for no Man." "Miser Counting Treasures." A collection of 100 photographs, nature prints, and chromo-lithographs, lent by the Society of Arts to the Institution for the occasion, amongst the most remarkable of which were "Faith," "L'Allegro," "Penseroso," "Bud and Blossom," and "Walter and Jane," from Bloomfield's "Farmer's Boy." A plan of a "New Public Town-hall, Wirksworth," designed by Mr. J. W. Pickard, of Manchester, attracted much attention.—Music, vocal and instrumental, and dancing, were added to the other attractions, the inhabitants of Wirksworth and its neighbourhood gratuitously affording their services in the orchestra. Tea was served in tents built for the occasion by Mr. G. Frost, and Messrs. Killer and Spencer, and covered with rick-cloths, along which were four tiers of tables. The tents were twice filled and no less than 1,780 partook of the refreshment. The arrangements for tea were most admirable. The farmers of the neighbourhood most liberally provided an abundant supply of cream; some idea may be gathered as to the quantity sent, from the fact that more than two gallons were left in store. Mr.

Joseph Wheatcroft purchased 130 tickets of admission, which he gave to the hands in his employ. Tea being over, the price of admission was reduced to 6d., and large numbers of people availed themselves of the opportunity, until the number of people on the ground exceeded 2,000. After tea, play commenced in right earnest, dancing being principally indulged in, though tag, leap-frog, and other games had their respective admirers. Amongst the company assembled at this time were Sir Henry Fitz Herbert's family, from Tissington-hall; J. Wright, Esq., and Mrs. Wright, Hulland-hall; Miss Arkwright and party, — Peel, Esq., and Mrs. Peel, Miss Hurt, Captain Hurt, Rev. T. T. Smith and family, Rev. J. Edwards and family, Rev. F. H. Brett and Mrs. Brett, Rev. C. H. Owen, Rev. R. M. Jones, T. Poyser, Esq., Mrs. and Miss Poyser, Dr. Webb and Mrs. Webb, Mrs. Newbold, W. Wright, Esq., J. Wheatcroft, Esq., and Mrs. Wheatcroft, A. Harward, Esq., and Mrs. Harward, J. Stone, Esq., and Mrs. Stone, Mrs. P. and Miss Hubbersty, Mr. E. Edwards, Miss A. Wall, Miss Sudlow, J. Allen, Esq., J. J. Kenderdine, Esq., Mrs. S. Hall, Miss Brace, Miss Stone, Mr. L. Alsop and Mrs. Alsop, J. Parkin, Esq., Messrs. Tatlow, Mr. J. Walker, Mr. R. Wall, Mrs. Allen, Miss Tomlinson, Mr. Kirkland, and the officers of the Institution—W. Cantrell, Esq. (president), Mr. M. Peel (vice-president), Mr. Surtees (secretary), Mr. Street (treasurer), Dr. W. Webb, Mr. Fryer, Mr. R. Wall, jun., Mr. T. Newton, jun., Mr. J. Baxter, Mr. W. Hall, Mr. T. Savage, Mr. W. Carrington (committee). About seven o'clock the chair was taken by T. W. Evans, Esq., who addressed the assembly at considerable length on the advantages of Mechanics' Institutions, making some very judicious observations as to the method of instruction which they should be the means of conveying. In conclusion, the chairman expressed the pleasure he had experienced at his visit, and congratulated the assemblage upon the success which had attended the festival.—Mr. Cantrell, as president, addressed the meeting upon the present condition and future prospects of the Institution. He characterised their position as a peculiarly happy one, and looked with hope for the future.—The Rev. J. Edwards then proposed the following sentiment:—"Prosperity to the Wirksworth Mechanics' Institution, and to all similar Societies, as the chief sources and most effective promoters of the intellectual cultivation of the people."—The Rev. F. H. Brett cordially seconded the sentiment.—Mr. E. Edwards proposed the next sentiment: "The continued enlargement of the means for the cultivation of taste among the people, and for the development of the great mechanical and engineering skill of the English nation," which he enforced by some judicious remarks and allusions to distinguished men who, by cultivating their minds, had raised themselves to their present proud position,—Mr. J. Fryer seconded the resolution.—Mr. Poyser moved the next sentiment: "The education of the people, as the means of the development of those high faculties with which the All-wise has endowed man; and, as, in this view, the source of the highest and purest earthly enjoyment."—Mr. M. H. Cantrell seconded the resolution.—Dr. Webb introduced the next sentiment: "The press, as the greatest providential manifestation of human means for promoting and securing the advancement of literature, science, and civilisation," and eloquently pleaded the cause of the Institution.—Mr. W. Wright seconded Dr. Webb's resolution.—Mr. E. Wass proposed, "The principles upon which these societies are based are those which, while they leave to every man the right of free judgment, yet, from their universality and truth, tend to produce in society the greatest amount of general good."—Mr. Carrington seconded the resolution.—Mr. Stone proposed "The Ladies," whose presence that day was one of the good things of the *fête*.—Votes of thanks were then, on the motion of the Rev. J. Edwards, passed to the musical friends; on that of Mr. Surtees, to the President; and on that of the President, to the Chairman.—The National Anthem was sung, and three hearty cheers given for the Queen, and three for Mr. and Mrs. Cantrell at the close. As soon as it was dusk, an illumination was displayed in front of the house, consisting of "V. A." with a star in the centre, in gas jets; and then the fireworks—a very creditable part of the programme—were let off under the superintendence of Mr. J. T. Marsh. The *fête* was entirely successful, and will long be remembered in the annals of Wirksworth. On Friday, the grounds were thrown open to all the children in the neighbourhood, and the ladies' and gentlemen's committees met and took tea together. After tea, dancing was introduced, and another evening passed most pleasantly. As so great a number of people were collected on Thursday, it was impossible to obtain more than a cursory view of the mineral specimens, &c.; Mr. Cantrell has therefore kept open the exhibition on the evenings of Saturday, Monday, Tuesday, and Wednesday.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 10*th July*, 1856.

130. Bills—Customs (No. 2).
224. Bills—Nuisances Removal, &c. (Scotland) (No. 2) (Amended.)
225. Bills—Consolidated Fund (Appropriation).
227. Bills—Unlawful Oaths (Ireland).
228. Bills—Militia Pay.
229. Bills—Grand Jury Cess (Mayo).
230. Bills—Railways Act Continuance (Ireland).
Public General Acts—Cap. 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, and 43.

Delivered on 11*th July*, 1856.

325. Prizes (Revenue Cruisers, &c.)—Abstract of Returns.
318. New Westminster Bridge—Plans.
178. Assurance Companies—Return.
130. Bills—Customs (No. 2) (a Corrected Copy).
223. Bills—Civil Service Superannuation (a Corrected Copy).
235. Bills—Episcopal and Capitular Estates Continuance.
232. Bills—Grand Juries (Lords' Amendments).
233. Bills—Cambridge University (Lords' Amendments).
234. Bills—Indemnity.
236. Bills—General Board of Health Continuance.
237. Bills—Formation, &c., of Parishes (as Amended by the Select Committee, and in Committee).

Delivered on 12*th and* 14*th July*, 1856.

253. Civil Contingencies—Returns.
336. County Surveyors (Ireland)—Returns.
342. Poor Relief (Birmingham, &c.)—Copy of Letter.
321. Constabulary (Ireland)—Statement.
326. Spirits and Malt—Return.
339. Fines and Penalties (Ireland)—Abstract of Accounts.
219. Bills—Criminal Appropriation of Trust Property.
238. Bills—Court of Appeal in Chancery (Ireland) (as Amended in Committee, and on Consideration of Bill, as Amended).
239. Bills—Judgments Execution, &c. (Amended).
240. Bills—Income and Land Taxes.
241. Bills—Ecclesiastical Courts, &c.
242. Bills—Stamp Duties.
243. Bills—Race-horse Duty.
244. Bills—Marriage Law (Scotland) Amending (Amended).
245. Bills—Formation, &c., of Parishes (as Amended by the Select Committee, in Committee, and on Consideration of Bill, as Amended).
246. Bills—Lunatic Asylums Act Amendment.
Convict Prisons—Report by Colonel Jebb.
Site of Smithfield—Report.
Criminal Offenders (Ireland)—Tables.

Delivered on 15*th July*, 1856.

248. Bill—Coast Guard Service.

Delivered on 16*th and* 17*th July*, 1856.

300. Wexford Harbour—Report of Captain Vetch.
344. County Treasurers Fee Fund (Ireland)—Account.
249. Bills—Evidence in Foreign Suits.
250. Bills—Charities.
251. Bills—Lunatic Asylums (Superannuations) (Ireland).
247. Bills—Imprisonment for Debt.
252. Bills—County Courts Acts Amendment (Amended).
253. Bills—Cursitor Baron of the Exchequer.
Public General Acts—Cap. 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, and 54.

Delivered on 18*th July*, 1856.

352. St. James's, &c., Parks—Account.
358. Income Tax, &c. (London)—Return.
359. Australian Postal Service—Copy of Tenders, &c.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette July 18th*, 1856.]

Dated 11th June, 1856.

1388. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of safety paper. (A communication.)

Dated 1st July, 1856.

1540. James Atkinson Longridge, 17, Fludyer street, Westminster—Improvements in the application of mechanical power to ploughing and other field operations of agriculture.
1542. John Lacey Davies, jun., and John Broadbent, Manchester—Certain improvements in umbrellas and parasols.
1544. Alfred Vincent Newton, 66, Chancery-lane—An improved construction of door lock. (A communication.)
1546. George Edward Dering, Lockleys, Herts—Improvements in galvanic batteries.
1548. Matthew Hill Loam, Nottingham—Improvements in meters for measuring water and other fluids.

Dated 2nd July, 1856.

1550. Joseph Henry Van Hengel, 531^{a}, Chaussée de Malines, Antwerp—Improvements in apparatus for raising and lowering bodies in mines.
1552. James Fleming, jun., Newlands-fields, Renfrew—Improvements in bleaching, washing, cleansing, and preparing textile fabrics and materials.
1554. Edwin Green, Birmingham—Improvements in the manufacture of buttons.
1556. Alfred Nourisson, 10, Rue des Petites Ecuries, Paris—Improvements in drying and burning bricks and other articles of clay.
1558. John Williamson and James Cochran Stevenson, South Shields—Improvements in evaporating saline solutions.
1560. William Hickling Burnett, Margaret-street, London—Improvements in electric telegraphs, and in apparatuses employed therein.
1562. Alfred Vincent Newton, 66, Chancery-lane—Certain improvements in machinery for manufacturing rope or cordage.—(A communication.)

Dated 3rd July, 1856.

1563. John Pendlebury, Crumpsall, Lancashire—Improvements in machinery or apparatus for bleaching or cleansing textile fabrics or materials.
1564. Joseph Ewing, Cirencester—A new or improved portable receptacle for urine and other human secretions.
1565. John Caleb Hall Peirce, Upper North-place, Gray's-inn-road—Improvements in glass chandeliers, lustres, and other such means used in lighting.
1566. David Curwood, Grocers' Hall Court—Improvements in horse rakes, which improved rakes may also be rendered applicable for scarifying land.
1567. Joseph Brown, 71, Leadenhall-street—Certain improvements in hats and caps.

Dated 4th July, 1856.

1568. Hilton Greaves, Oldham—Improvements in looms for weaving.
1569. Edwin Greenslade Bradford, Torquay—An improved rudder.
1570. Thomas Chandler, 58, Paradise-street, Rotherhithe—A lever cask stand.
1572. Robert Luke Howard, 85, Whitecross-street, London—Improvements in valves for regulating the flow of fluids.
1573. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for cleaning and carding cotton and other fibrous substances. (A communication.)
1574. Louis Cornides, 4, Trafalgar-square, Charing-cross—Improvements in cementing and uniting together plain or ornamented surfaces of glass, or in uniting surfaces of glass to surfaces of metal or other material.

Dated 5th July, 1856.

1575. Edwin Travis, Oldham, and Joseph Louis Casartelli, Manchester—Certain improvements in steam engines.
1576. Jens Foss, Manchester—Improvements in machinery for cutting and sawing.
1577. Joseph Adshead, Manchester—A new application of a known material to be used as a substitute for plastering, painting, papering, whitewashing, and colouring.
1578. Joseph Lewtas and John Humphreys the younger, Manchester—Improvements in apparatus for holding and releasing cords, chains, bands, or bars.
1579. James Alexander Manning, Inner Temple, London—Improvements in the manufacture or production of manure.
1580. Paul Charles Joseph Léonce de Combettes, Lyon, France—An improved steam-engine.
1581. Jean Marie Letestu, Paris—Certain improvements in extracting liquids and solid or pasty matters.
1582. Thomas Smith, Bredfield, Suffolk—Improvements in horse rakes.
1583. Lorenzo Blackstone, Lawrence-lane, London—Improvements in the manufacture of corks and bungs. (A communication.)

Dated 7th July, 1856.

1584. Frederic James Pilliner, Hatfield-street, Stamford-street, Blackfriars-road—Improvements in clasps or fastenings for waistbands and other descriptions of bands or straps.
1585. Robert Millward, Patricroft, Manchester—An improved instrument which may be used as a screw key or gauge.
1586. Robert Shaw, Portlaw, Waterford, Ireland—Improvements in obtaining pressure applicable to machinery for preparing and spinning cotton and other fibrous materials, and other purposes.
1591. George Sampson, Bradford—Improvements in finishing fabrics.
1592. William Colborne Cambridge, Bristol—An improvement in the construction of press wheel rollers and clod crushers.
1593. Henry Smith, Brierley Hill Iron Works, Dudley—An improvement or improvements in the manufacture of harrows.
1594. James Horsfall, Birmingham—An improvement or improvements in the manufacture of wire rope.
1595. William Laing, Denny, Stirling, N.B.—Improvements in stretching or breadthening woven fabrics.
1596. Paul Charles Joseph Léonce de Combettes, Lyon, France—Certain improvements in rotary steam-engines.
1597. Edward Charles Healey, Sidmouth-lodge, Old Brompton, and Edward Ellis Allen, 376, Strand—An improvement in preparing for use veneers, paper, and other fabrics or sheets made of fibres.
1598. Henry Bollmann Condy, Battersea—Improvements in defecating or purifying acetic acid and other solutions, also in disinfecting rooms and other places, and in preserving wood.
1599. John Henry Noone, 1, Peter-street, Sun-street, Bishopsgate—Improvements in apparatus for retarding and stopping carriages on railways.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 18th, 1856.

135. Miguel de Bergue.
149. Edward Pickering.
157. John Coope Haddan.
177. Alexandre Tolhausen.
189. Charles Rothwell.
237. William Henry Lancaster and James Smith.
282. George Norgate Hooper and William Hooper.
299. Elisha Smith Robinson.
785. Etienne Laporte.
1118. Barnett Samuel.
1179. John Wilkes, Thos. Wilkes, and Gilbert Wilkes.
1219. John Charles Pearce.
1223. Job Cutler.

Sealed July 22nd, 1856.

185. Stephen Norris.
190. John Strafford.
191. John and George Gimson.
198. Andrew Shanks and Francis Herbert Wenham.
210. George Napier.
212. Edward Vincent Gardner.
218. William Beasley.
222. John Wormald.
230. William Asbury.
287. Benjamin Franklin Miller.
289. James Townsend Ward.
310. Michael Leopold Parnell.
3. Richard Archibald Breeman.
340. Charles Walker.
369. Richard Archibald Brooman.
464. George Holme Spencer.
573. Frederick Hale Holmes.
748. Samuel Getley.
1066. William Edward Newton.
1213. Edward Hammond Bentall.
1288. William Needham and James Kite (Secundus).
1316. Christian Rudolph Wessel, and Francis Xavier Kukla.

Patents on which the Third Year's Stamp Duty has been Paid.

July 14th.

1688. Charles Goodyear.
1690. Charles Goodyear.
1693. Charles Goodyear.
1694. Charles Goodyear.
1695. Charles Goodyear.
1701. Benjamin Burrows.
1714. Charles Breese.

July 15th.

1705. John Wallace Duncan.
1728. Edward Cockey, Henry Cockey, and Fras. Christopher Cockey.
1731. Thomas Gray and John Reid.

July 16th.

1736. William Huntley.

July 18th.

1712. Peter Armand le Comte de Fontainemoreau.

July 19th.

1718. James Shield Norton and Henry Jules Borie.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3857	July 11.	Improved Date Indicator	Waterlow and Sons	London Wall.
3858	„ 14.	Needle Case	A. G. Baylis and Co.	Redditch.
3859	„ 15.	Watercloset Cistern for constant supply	James and Matthew Robson	North Shields.
3860	„ 17.	Nouvel Albert Boot	Henry Whittell	Leamington.
3861	„ 24.	Fastening for Bottom of Railway Hopper Waggon	William Prince Marshall and John Ross	Birmingham.
3862	„ 24.	Gas Stove	George Neall	Northampton.

Journal of the Society of Arts.

FRIDAY, AUGUST 1, 1856.

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EXEMPTION FROM RATING.

Owing to the early prorogation, it has been found impossible to carry through both Houses of Parliament, this session, the Bill for amending the law relating to the exemption of Institutions from local rating. The Bill is, therefore, necessarily postponed. It will, however, be re-introduced early next session. From the discussion which has taken place, there appears reason for hoping that the Bill, with certain alterations to meet the views expressed in the House, will then pass into a law. In the meantime, the Bill, as amended, will be printed, in order that the Institutions may have a further opportunity of discussing its provisions and suggesting improvements.

BRUSSELS CONGRESS.

Some confusion seems to have arisen from the circumstance that two International Congresses are shortly to be held at Brussels; the one for improving the physical and intellectual condition of the working classes, to be opened on the 15th September; the other, for promoting the principles of free trade, to be opened on the 22nd of the same month. The object of the latter is to collect, "from every country and every industry,—in one word, from every branch of human activity,—every fact, every information, every law or regulation which may affect, for good or evil, labour in each country, either by hindering or facilitating the exchange of the results of that labour against foreign productions." The other is intended to induce a better knowledge of the actual condition, wants, and resources of the industrial population in various countries, and to encourage the adoption of the most practical means for improving their health and comfort. With this view it will be connected with the Exhibition of articles of domestic and sanitary economy, which is to be opened on the 25th August, and closed on the 5th October.

ON NEGATIVE ARTESIAN WELLS, OR ABSORBING BORED WELLS, AS A MEANS OF DRAINING LANDS, FARMS, BUILDINGS, &c.[*]

By Augustus Edward Bruckmann, Ph. Dr., Consulting Engineer and Geologist.

(*Continued from page* 612.)

The accurate construction of *positive artesian wells*, and especially the determination whether their establishment under certain conditions and local circumstances is likely to be successful or not, supposes a fundamental knowledge of geology and subterraneous hydrography based on numerous practical observations.[*] The same degree of scientific and practical knowledge is requisite for establishing negative bored wells, or considerable mistakes will occur and large sums be wasted.

Therefore, if any undertaking is to be made, whether positive or negative, it is of no use to consult mere well-sinkers; for those people in general, know nothing but the particular beds of their respective districts, and only possess some practical knowledge of operating. The following warning fact may throw some light upon this matter:—

Two years ago, a noble landholder invited me to examine his somewhat elevated estate near the town of Leonberg, in Wirtemberg, in order to obtain my opinion on the boring of a positive artesian well, the execution of which had already proceeded to a depth of 265 feet. On examining the spot where the work had been undertaken, near the proprietor's castle, from which a steep slope descended to the bottom of a neighbouring narrow valley, I found the formation there deposited belonged to the upper shelly limestone (muschelkalk). During the execution of this boring, they had cut through partly positive, partly negative strata; once the column of water which was met with rose a little, another time it fell back again to a still greater depth than before, but its level remained always many feet beneath the surface of the soil; for that locality is such that the establishment of a true artesian well could never be successful. The individual undertaking this boring-work belonged to the class of common workmen, had been formerly employed as a day-labourer by a boring establishment, and was entirely ignorant of any geological formations, as well as devoid of any scientific cultivation. He predicted to the landholder a successful termination of the undertaking, and would have continued the work if I had not been called in and stopped the useless perforation, and given other advice. If I had been consulted in due time, that is, before the commencement of this unsuccessful boring, I could have saved the landholder a large sum, and supplied his castle with a stream of drinking-water in another and simpler way.

Thus a negative bored well was here established, capable of taking in and carrying off a vast quantity of superfluous waters, while the intention was to get a positive artesian well.

In England, likewise, deplorable disappointments have been met with in establishing positive artesian wells, and, as it seems, on a larger scale than in Germany and France; thus I find, in the interesting work of Messrs. Swindell and Burnell,[*] the following passage, pp. 24-25:—

"The existence of causes susceptible of modifying to so great an extent the success of an operation of this kind is not sufficiently known, either to the public in general, or to those who by their professional position ought to be better informed. Unfortunately, the *science* of well-boring does not exist in England, and the execution of this description of work is usually left to mere practical men. The consequence has been, that several wells have been commenced, have given rise to great outlay, and, after disappointing the hopes of all concerned, have been abandoned. It is true that the knowledge of the geological disturbances of strata, often hidden entirely, must be always, to a great extent, hypothetical, but there are indications sufficiently clear to lead any practised geologist to say beforehand whether any disturbance or fault exist likely to compromise the work proposed to be executed. With the most elaborate investigation, and the most extensive knowledge, there is always a degree of chance about the first well bored for the purpose of reaching deep springs in any district. It is not, therefore, surprising that the majority of the attempts hitherto made in our country should have been failures."

As for the deep and unsuccessful boring at Southampton, on the Common, two accounts are to be found in the same work, pp. 25-27, and pp. 88-90, which are so remarkable that I cannot forbear to quote here at least the first of them :—

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[*] Compare: The "Penny Cyclopædia" of the Society for the Diffusion of Useful Knowledge, Volume II., pp. 412-414. where will be found a short and popular essay on *artesian wells*, the following lines of which correspond with what I have written above:—"It must be apparent from these considerations, that extreme caution is necessary in the choice of situations for sinking to obtain artesian wells, and that general geological knowledge of the country, in which the attempt is to be made, should precede any borings for this purpose, otherwise much useless expense may be incurred, without a chance of success. Indeed, the power of pointing out those situations where artesians wells may, in all probability, be successfully established, is one of the applications of geology to the useful purposes of life."

[*] Rudimentary Treatise on Well-Digging, Boring, and Pump Work, with Illustrations. London: John Weale, 1854.

"The well at Southampton has afforded also some very important lessons with respect to the disturbances or modifications likely to be met with in the prosecution of such works. It was commenced at a point about a mile and a half from the sea, and 140 feet above the level of the high tides. As too frequently happens, no survey of the entering ground of the green-sand formations was made before commencing it, nor were the disturbances of the chalk strata, the only ones exposed in a manner able to furnish any valuable indications, taken into account. Now it happens that the green-sand ridge is disrupted in several places on the edge of the basin supposed to hold the waters from which the well was expected to be supplied, and important rivers flow away from it at those places, at levels little above the ground at the well. Should a water-bearing stratum exist, therefore, the water can rise very little above the ground, even supposing that all the other necessary conditions be fulfilled. But the whole of this part of the country has been disturbed in a very remarkable manner. A very strongly-marked fault exists in the chalk near Winchester, and continues to the sea shore near Portsmouth. The sea has formed two large breaches in the containing basin of the green-sand on the east and west of the Isle of Wight. At the back of the island the marks of geological disturbance are even more evident than upon the north of Southampton; the strata are contorted, and even tilted up in a vertical direction. The same facts occur also more to the south west, near the Isle of Purbeck, so that there appears little reason to believe that the basin is continuous, and at any rate the sea is in direct communication with the green-sand formations; if, therefore, it do not affect the quality of the water contained in the green-sand, it must regulate the water line, and cause it to take a regular inclination corresponding nearly with a line drawn from the last great inland overflow to the sea water level. But it is found that the water obtained from the chalk itself in the present state of the work is strongly affected by the infiltration through the body of the rock from the sea. If this be the case with a substance comparatively so dense as the chalk, the probability that the same effect will take place with the more pervious materials of the subcretaceous rocks, amounts almost to a certainty.

"Again, in all cases where wells have been sunk to a great distance from the surface, it is known that at a certain point the temperature becomes constant, and that beyond this it increases according to a law susceptible of modification by local circumstances. Mr. Paterson (Edin. New Phil. Mag., 1839) gives the mean rate of increase in Scotland as being about 1° Fahrenheit for about 48 feet of descent. M. Walferdin found in Paris the increase was at the rate of 1.8 Fahrenheit for every 102 feet 10½ inches (or 1 centigrade for 30m. 87.). M. de Girardin found at Rouen that it was about 1.8 for 67 feet 4 inches in one case, and 1.8 for 100 feet descent in another, whilst the more accurate experiments upon the artesian well of Grenelle, show that the increase there is with remarkable regularity, 1.8 Fahrenheit for 106 feet descent below the point of constant temperature, which is about 93 feet 6 inches from the surface of the ground at the Observatory of Paris, and marks a little more than 53° Fahrenheit.[*] This would give an increase of temperature of about 1° Fahrenheit to 59 feet descent. This important law does not appear to have been much attended to in England, or certainly, as in the case of Southampton, the notion of obtaining the whole supply of the town from a deep-seated artesian well would never have been entertained. The boring has been carried to a depth of 1,320 feet nearly, still in the chalk, so that, even did a supply of soft water exist at that depth, it would have a temperature of nearly 75° Fahrenheit; and as in all probability it would be necessary to descend 250 feet deeper before a copious supply could be obtained, the water from that depth would be about 80° Fahrenheit. From these combined reasons the town of Southampton have been induced to abandon the boring on their Common,—unfortunately not before they had spent a very large sum of money upon a work, which, if a survey of the district had been made by a competent person, would never have been commenced."

The establishment of absorbing bored wells, principally for agricultural purposes, is in many cases not expensive, because the intended purpose "to sink the waters" can often be attained at an inconsiderable depth; their execution, therefore, requires in many cases only a simple boring apparatus, often only a hole of small diameter, about 4 to 5 inches, and but few preparatory works, of course, on the supposition, that we should not be obliged previously to sink deep shafts. Whilst executing the negative artesians wells at Stetten, above Lonthal, which I shall have occasion to speak of in the second division of this paper, I had, it is true, my whole complete boring apparatus with me, but I effected both these works by the application of only a few simple instruments, for no accident happened, and I may assert that frequently, especially in clayey soil, a simple augur, turned by hand, will be sufficient.

On the other hand, it may certainly happen that deeper holes are required to be sunk through different beds, in order to meet with absorbent strata, clefts or subterranean currents, which will answer the intended object. Thus, for example, the negative artesian well at the knacker's yard at Bondy, in France, reaches to a depth of 300 feet, and carries off in twenty-four hours 100 cubic metres of water, of which A. Chevalier gives an account in his valuable memoir in the "Journal des Connaissances Usuelles," for December, 1835[*]; at the same time, describing some other negative artesian wells established in France between the years 1830 and 1840, he draws our attention to the important circumstance that great caution is necessary in sinking absorbing bored wells, especially if they have to take up injurious, infectious fluids, so as not to do any harm to neighbouring wells. On this point this author says, in an impressive manner, among other things :—

"My plain opinion is, that (*negative*) artesian wells in cities, and generally in large towns, can be made use of with great advantage for health, for owners of houses, as well as for agriculture, as means of drainage, if none of the above-mentioned disadvantages are to be apprehended. With respect to health great advantage might be derived from them, for they would enable us, 1st, to establish in larger institutions, as *e.g.* in barracks, hospitals, infirmaries, &c., water-closets à la Gourlier, as they are called, and to carry off, into a subterraneous water stratum, the urine which separates from the solid substances. 2nd. We might proceed in a similar way in distinct quarters of towns, and likewise establish for any particular groups of houses a drainage for the urine and other infectious fluids.[†] 3rd. Finally, sewers, which are often so detrimental to health, might in this manner be done away with. The owners of houses would receive this advantage from them, that their expenses for clearing would be diminished, since only solid substances would remain in the sinks, which are easily converted into manure as they lie, or would certainly be bought at good prices by the compost manufacturers. For agriculture, lastly, the considerable advantage would arise, that manure, which hitherto, not unfrequently, is in a great measure lost, could be prepared quickly, and without any detrimental infection of the atmosphere.

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[*] The observations on the increase of the temperature in the bore at Grenelle, made by Messrs. Arago and Walferdin, are given pp. 246-247, in my appendix to the German edition of "Viollet's Théorie des Puits Artésiens," according to a direct communication which I received from M. Viollet in Paris, July 4th, 1841.

[*] Or German translation, see "Dingler's Polytechnisches Journal," sechzigster Band. 1836, pp. 58-61. "Ueber die Ableitung übelriechender und für die Gesundheit nachtheiliger Flüssigkeiten in unterirdische Wasserströmungen. Von Herrn A. Chevalier.

[†] "To this the objection might be made that this measure would be impracticable at the present time; but, on the other hand, we must remind our readers, that, in measures for health in a large town, we should pay regard not only to that which can be performed immediately, but also to that which may be

"I confine myself to these few remarks for the present, for my purpose is only to turn the public attention to a method, which, in my opinion, is likely to become of great advantage, but which cannot be executed till it has been practically shown that none of the above-mentioned detriments can arise from it. If that should be the case, a great advantage would be conferred upon the factories of starch and salt, slaughter-houses, washing establishments, dye-houses, distilleries, and many other factories in which it is often difficult to get rid of the foul waste waters, and against the erection of which the whole neighbourhood usually complains. The permanent sewers also, which, at present, infect whole communities, could easily be got rid of by this method."

Even the waste water of common flowing and artesian wells can often be led off into absorbent strata, if the local conditions are unfavourable to the establishment of channels, drains, or canals. Suppose we have bored a spring rising and delivering itself on the surface of the soil; and, in order to prevent any loss of water hereafter, we have previously been obliged to isolate a negative (absorbent) stratum by means of tubes. In such a case, I say, in order to carry away the superfluous water, nothing better can be done than to bore a second hole in the same shaft in which the artesian well has been constructed, down to the underlying negative stratum, and to lead the water in question into the latter, premising that the absorbing power of the said stratum has previously been ascertained.*

I have even gone beyond the expedient just proposed, as the following fact will show:—

Towards the end of the year 1830, after I had successfully established an artesian well in the keuper formation (upper division of the trias deposit) of a large town in Bavaria, I let its superfluous water flow directly down into the boring-shaft itself, in order to avoid an expensive construction of channels. The latter was sunk in the superincumbent diluvium (sand, gravel, pebbles, and boulders), and the water thus led into it runs away entirely, without in the least injuring the neighbouring cellars, &c., because the bottom of the shaft lies deeper than the bottoms of the latter.

A tap should never be put into the tube of an artesian well for drawing off its waters as required, as it is injurious to check their flow.

F. Degousée discusses clearly, in his "Guide du Sondeur,"† (Paris, 1847) sink-wells and their advantages, principally speaking of those which are adapted for large manufactories, &c., and quoting the chief police regulations published in France on the 10th June, 1838, relating to the absorption of noxious water.

In the first article, we find—"No common or sink-well is to be bored, no bored hole or the like is to be undertaken, before a previous declaration in writing has been sent to the prefect of police at Paris, and to the mayors in the country districts. This declaration must point out the place where such undertakings are intended to be carried out."

In the fourteenth article we read—"No sink, or sink-well, shall be established without special permission; but this will be given, if it can be done consistently with the declaration prescribed by the first article."

"The depth of the sink-well will be fixed in the license, if granted."

"All the regulations for sink-wells must be applied to such sinks as shall be executed above or near sink-wells."

At the same time Degousée draws attention to the fact that a bored well can absorb as much water as it is capable of supplying, and he points to a successful proceeding which some landlords in France make use of to drain districts which are so marshy that they cannot be used. They perforate with the augur the impervious surface-bed, which is generally of inconsiderable thickness, till they reach the porous or absorbent stratum; this perforation is always made in the furrows from 100 to 200 metres distant, and is quickly done. In order to prevent a stoppage of such absorbent bored holes, they are protected at the top by a basket-work of briers or brushwood, and a fascine is also put into every bored hole.

This simple and cheap method of drainage deserves the preference, in some cases, over the tube drainage, which is expensive, occasionally stopped, and therefore requires repeated repairs;* it can be successfully executed in many other countries and formations wherever the natural conditions are favourable, which a clever and experienced engineer and geologist cannot fail to discover.

This kind of drainage, by means of borings, although sometimes it is necessary to carry it out in a somewhat more complicated manner, is of great importance for agriculture in cases where the rain water, for want of fall, cannot flow off, and the upper ground is too clayey to allow the infiltration of it. Under such circumstances, of course, it must remain on the surface of the soil as a stagnant fluid, and produce an injurious effect upon the vegetation, for evaporation, although highly active during some hot months in the year, cannot carry it off entirely.

We must not by any means imagine that for the drainage of marshy countries, wet cellars, &c., it is absolutely necessary after the perforation of the upper impervious beds (potter's clay, clay marl, &c.), to meet with an extensive ramification of fissures, negative strata or subterraneous currents, into which the waters to be carried off flow down and disappear. If beneath the impervious mass are deposited sand, gravel, pebbles, sandy clay or sandy marl, &c., these beds suffice in many cases for a permanent, though occasionally a slow absorption. But if the quantity of water to be sunk should be considerable and continually renewed, then of course,

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done in the time to come. Besides, from time to time entire streets are newly built, and in such cases the proceeding in question might be applied by compelling the proprietors of houses to build in such a manner, that the fluids running off from the sinks might disappear in a well to be established in the middle of the street. The owners of the houses would willingly submit to such an arrangement, since it is proved that the sinks contain a very small quantity of solid substances in comparison to the fluids, and so the respective proprietors would have to pay much less for clearing them."

* M. Arago notices, in the "Annuaire pour l'an 1835," pp. 246-247, a remarkable boring at St. Denis, accomplished by M. Mulot, involving at the same time a positive and a negative artesian well—a proceeding which in some cases is practicable.

† Or see pp. 105-109 of the German translation of this book. "Die Anwendung des Erd-oder Bergbohrers zur Aufsuchung nützlicher Mineralien, als Bausteine, Kalk, Stein-und-Braunkohlen. Steinsalz u. dgl. m., zum Schürfen oder zur Erforschung der Erzlagerstätten. zum Erbohren von artesischen Brunnen, von Senkbrunnen und von Salzquellen; zur Verschaffung von Wasser—und Wetterlosung in den Grubenbauten und Steinbrüchen, wie auch zur Erforschung des Grundes für ökonomische und bauliche Zwecke, und endlich zum Sprengen von Felsen unter dem Meeresspiegel. Von I. Degousée, Civil Ingenieur. Mit Benutzung der neuesten Belehrungen und Anweisungen von Amedée Burat. Aus dem Französischen. Mit 25 Tafeln Abbildungen. Quedlinburg, Druck und Verlag von Gottfr. Basse. 1851."

* At least according to the experience of many in Germany.

powerfully absorbent strata, clefts, or cavities, must be opened up with a hole of larger diameter, even if necessary to descend to a considerable depth.

It may be seen by what I have said up to this point, that the establishment of absorbing bored wells, admits of numerous most important and economical practical applications as well to manufactures and agriculture as the purification of the air in populous towns, &c. It is to be hoped that the time has now arrived when a more general attention will be paid to this useful object.

As it is well-known that by running waters, fountains, &c., the air is purified, so the same salutary effect can be produced by leading off injurious fluids into absorbent holes. Let us go still further. What advantages and beneficial effects might not be expected from the establishment of negative artesian wells[*] in certain distant southern countries on the shores of the sea, where, by a continued formation of mud-beaches, marsh, and decomposing vegetable matters, miasmata continually rise, poison the air, and thus produce typhus and intermittent fevers, rendering the colonisation of those otherwise so highly productive countries extremely difficult. I refer more particularly to Guiana and Java.

Let us hope that the governments who in their colonies have marshy unhealthy districts, will take up this idea; the result will show them that such works would benefit their subjects and increase their own prosperity. The following example on the European continent is calculated to support my assertion:—

Since the works of drainage at Laibach, now nearly finished, have been energetically undertaken, although executed in the common way, not only much fertile land for culture has been acquired, but also the climate of Laibash and all its environs has essentially improved.[†]

England appears, up to this day, not to possess an absorbing bored well, or at least no perforation which has designedly been undertaken for getting rid of superfluous or injurious waters; thus I find in the above-mentioned "Rudimentary Treatise on Well Digging, Boring, and Pump-work" (London, Weale, 1854), pp. 6-7, the following passage:—

"There is, however, an application which is not sufficiently known in England, notwithstanding that an account of it has appeared in some of our professional journals; it is in the formation of absorbing wells, by means of which the waste waters of some branches of industry may be removed by their being carried down to an absorbent substratum, and some curious natural laws have been divulged by the experiments to which such works have given rise."

Then, on page 7, these remarks from Degousée's "Guide du Sondeur:"—

"Thus, it has been proved that a well can absorb a quantity of water equal to what it yields. If, for instance, a boring yield 100 gallons per minute, and the water cease to ascend at three feet above the ground, by merely lengthening the tube three feet in addition above the permanent level of the water, 100 gallons may be continually poured in per minute without flowing over the orifice of the tube. If it be desired to make such a boring absorb, say 500 gallons per minute, a pump able to raise that quantity is inserted in the well, and notice is taken of the depth to which it can lower the water-line. If we suppose it to be 15 feet, for instance, it will be sufficient to place a column of that length above the water-line, and the boring will absorb the quantity of 500 gallons. Should the water-line be below the surface of the ground, the absorption by this description of well may be indefinite.

"Care must be taken to prevent any solid matters in suspension in the waters proposed to be absorbed from being carried into the boring, or they would rapidly choke it up. Precautions also require to be taken to prevent the contamination of neighbouring wells."

In Mr. Dempsey's very interesting "Rudimentary Treatise on the Drainage of Districts and Lands" (London, Weale, 1854), negative artesian wells are a few times mentioned, but without naming any practical work of this kind in England. We find at pp. 41-42 this account:—

"Borings similar to those for artesian wells have been executed for the purpose of getting rid of superfluous water and liquid matters. An embankment near Val de Fleury, for the left bank of the Versailles Railway, was drained in this manner by means of *absorbing wells*. A stratum of clay and sand, soaked with the rains of the previous year, forced the bank from its position and destroyed the works. Borings were made, the first of which reached 20 yards in depth, where it arrived at the upper part of the chalk, full of fissures, and which speedily absorbed the water. The subsequent borings were carried to 35 and 40 yards, in order to reach the chalky fissures which communicate with the Seine, and feed the neighbouring wells. Absorbing wells have also been used in France to dispose of the refuse of the lay-stalls. M. Mulot, who superintended the Grenelle artesian well, executed a boring for this purpose at Bondy.[*] Through a perforation 244 feet in depth, two absorbing strata were obtained, one at a depth from 133 to 155 feet, in chalk mixed with silex, and the other from 210 to 244 feet, in argillaceous sand and green and gray sands, containing lignites and pulverized shells. By the first, 70, and by the latter, 140 cubic yards of refuse liquid were absorbed."

After Mr. Dempsey has described Mr. Elkington's deep draining, which took place in the year 1764, he says in sect. 158 (pp. 132-133) of his book—

"The process of tapping is evidently available only when the spring is fed from a higher level, so that the pressure shall suffice to force the water upward through the augur-hole. Another method is sometimes adopted as a substitute for the augur-hole or vertical bore, namely, digging a well of depth proportioned to the pressure, and filling this well with loose stones, through which the water will rise, and thence pass away along the drain, with the bed of which the well communicates. *Similar augur-holes, or wells, may be adopted to effect the precisely opposite object, viz., to make a downward passage of the drainage-water from the drains which intersect an upper and clay stratum only, into a more porous bed beneath, in the body of which the water will become dispersed.*"

The last part of this paragraph is of importance in our considerations, and is calculated to encourage the establishment of negative artesian wells, the more so that it does not hint at the existence of any absorbing bored well in Great Britain, therefore, what I have said in the former pages receives a further confirmation.[†]

It is not my intention to describe here the technical process of boring and the progress made in the art of late; I have already done this in some other works, and some years ago I wrote further on the latest improvements in that art.[*] Th ereader will have an opportunity, in the course of this paper, of becoming acquainted with my more important literary works, in which he will, among other things, find that my practice in the difficult sinking *water-tight tubes* through the *diluvium* (sand, gravel, pebbles, boulder-stones, &c.), is essentially different from that of other engineers, as will be seen on referring to pp. 89-90 of the work cited below, "Wegweiser, &c." In this book I have quoted and partly criticised whatever of interest the German and French literature furnishes in reference to borings, and I believe that scarcely any important work on this subject has escaped my notice. The English literature was, except some articles translated in German journals,[†] less accessible to me, nor did I understand the English language some years ago; but I have given an historical view and description of several artesian wells, heretofore established in England, pp. 308-313, in my first quoted work, "Vollständige Anleitung zur Anlage, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen" according to an account in the French work of M. le Vicomte Hericart de Thury: "Considérations Géologiques et Physiques sur la cause du Jaillissement des Eaux des Puits forés ou Fontaines Artificielles," &c.

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[*] Indeed of positive artesian wells, too;—both can subsist side by side.

[†] See, Reisen im südöstlichen Deutschland von I. G. Kohl. Zweiter Band, Leipzig, Friedrich Fleischer, 1852," p. 357, &c.

[*] Already mentioned by me in the preceding pages.

[†] When writing the above, I had no other means of information than that afforded by English published works, as far as I was acquainted with them; but I have lately learnt, in communications I have had with scientific gentlemen—Messrs. E. Binney, in Manchester, S. C. Homersham, and J. Prestwich, jun., in London—that, in England, not only sinks or sink-holes (common in Germany and France), in the upper chalk, but also a few real negative artesian wells (absorbing bored wells) in other formations, have already been established successfully. It would be of great interest to be acquainted with the results obtained.

In addition, I would call the reader's attention to a new and interesting treatise on "Well-Sinking and Earth-Boring Apparatus," given by Mr. David Chadwick, Assoc. Inst. C.E., of Salford, in the supplement to the *Mining Journal*, No. 1,088, Vol. XXVI., London, June 28th, 1856. This paper contains a brief summary of Mr. Chadwick's original manuscript of the above subject, read by him before the Manchester Literary and Philosophical Society, giving a history of wells and well-sinking, commencing with the earliest scriptural records, and continuing down to the present time. He mentions, among others, the name of my late father, von Bruckmann, in reference to the artesian wells at Heilbronn, in Wirtemberg, and my name in respect to negative artesian wells, being acquainted with my latest work published in Germany. As Mr. Chadwick was kind enough to allow me the perusal of his manuscript when I was at Salford, I can only remark, that in the *Mining Journal* a great portion of his paper has been omitted. Mr. Chadwick's final remarks refer to Mr. Colin Mather's invention in earth boring,[‡] a full description of which, with diagrams, furnished by Mr. Mather, appeared in the *Journal of the Society of Arts*, Vol. III., No. 132, June 1, 1855, under the head, "On Earth-Boring Machinery," to which a valuable discussion is added. A description will also be found in the *Mining Journal* of June 9th, 1855.

Since my arrival in England, where I have now spent a year, I have discovered why all my former researches, in Germany and France, to obtain English works on artesian wells and borings in general, were necessarily fruitless, for I read in the book already quoted (by Messrs. Swindell and Burnell), pp. vi.-vii., the following lines:—

"In our own language, we can hardly cite any other work than Mr. J. Prestwich's 'Treatise on the Water-bearing Strata of London;'[*] but it is a host in itself, and contains proof of a skill, judgment, and careful observation, which justify our regarding it as a model of practically applied science. From the detached papers by Mr. Clutterbuck and Mr. Dickinson, in the reports by Messrs. Stephenson and Homersham, much valuable information may be obtained, as also occasionally from the reports of the superintending inspectors of the Board of Health."

It would far surpass the limits of my present paper on "Absorbing Bored Wells," to say much on positive artesian wells, and to speak of the technical methods of boring. On the latter subject we find a short account in the work of Messrs. Swindell and Burnell, in chap. v. pp. 38-51; and on p. 51 the words:—

"It must not be understood that the above description comprehends every tool used by well-borers. Each contractor, in fact, has his own system, and the nature of the ground to be operated upon varies so much in one locality from what it is in another, that every case requires to be treated, as it were, upon its own merits. In M. Degousée's work[†] will be found ample illustrations of the various tools he has employed in his extensive practice, and the reader who would desire further information upon this subject, is referred to it and to Burat's 'Géologie appliquée à la Recherche des Minéraux utiles.'"

I confine myself to a few remarks on Chapter V., just quoted, because the authors do not mention in any way the German literature on borings, though it is at present more copious and contains more important matter than the French.

At pp. 46-47, it is Herr von Althaus, and not Herr von Oeynhausen, who invented the slide-joint (German: Bohrscheere, Rutschsheere, or Wechselstück), as may be seen from the note on p. 120 of my "Wegweiser durch den Berg-und Brunnenbohrwald." The mistake that Herr von Oeynhausen is the inventor of the slide-joint long prevailed even in Germany.

The most important progress in the art of boring made lately, is the invention of the dropping-borer, or free-falling tool (German: Freifallbohrer, Freifallinstrument, or Abfallstück), not well known to M. Degousée when he published his work, as will be found on pp. 77 and 85 of my "Wegweiser, &c." It was Mr. Rost who invented this interesting boring-tool, which is principally useful for deep borings, and after he had communicated his idea to Mr. Kind, the latter constructed it in the year 1844, and first made use of it at Mondorf, near Luxemburg, to a depth of 713 metres. This perforation is at present the deepest in the whole of Europe, for we know that the artesian well in the slaughter-house at Grenelle, near Paris, reaches only to a depth of 548 metres.[‡] In my "Wegweiser, &c.," I have so often mentioned the dropping-borer (Freifallinstrument), and spoken of it so much, that I cannot do better than to refer to this book, of which a review is to be found in the "Heidelberger Jahrbücher der Literatur, Nr. 10, 1853, p. 145," as I have already remarked.

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[*] See my Wegweiser durch den Berg-und Brunnenbohrwald oder chronologische Zusammenstellung der über Bergbohrkunde Anlegung artesischer und gewöhnlicher Brunnen, wie auch Quellenbildung, erschienenen älteren und neueren Literatur in selbstständigen Werken und zerstreuten Aufsätzen, nebst manchen kritischen Bemerkungen und Erläuterungen über dieselben. Ein Handbuch für Alle, die sich mit Berg-und-Brunnenbohrungen, auch Brunnenanlagen überhaupt beschäftigen oder dafür aus ökonomischen Gründen interessiren. Darmstadt, 1852. Verlag der Hofbuchhandlung von G. Jonghaus." A review of this book is to be found in the "Heidelberger Jahrbücher der Literatur," Nr. 10, 1853. p. 145.

[†] See for example: y^{3} p. 121, and n^{5} pp. 142-143, concerning the accounts of Messrs. Robert Beart, at Godmanchester, and William Gosswych Gard, at Calstock, in my "Wegweiser durch den Berg-und Brunnenbohrwald."

[‡] I may be allowed to remark that boring heads, similar to that of Mr. Colin Mather's, about twenty years ago were tried in Germany in combination with the Chinese system, but have been since abandoned, *e.g.*, by Messrs. von Alberti, von Althaus, Froman, Kinderman, von Sello, and others. Those who wish to inform themselves on this subject, may be pleased to read the works and detached papers quoted in my "Wegweiser durch den Berg-und Brunnenbohrwald."

[*] A geological inquiry respecting the water-bearing strata of the country around London, with reference especially to the water-supply of the metropolis; and including some remarks on springs. By Joseph Prestwich, jun., F.G.S. London: John van Voorst, Paternoster-row, 1851. Indeed an excellent work.

[†] I have given a review of Degousée's work, pp. 76-91, in my "Wegweiser durch den Berg-und Brunnenbohrwald." This may be of interest to those who possess Degousée's book.

[‡] See the Manchester *Examiner* and *Times*, March 22, 1856. M. Dumas has lately communicated to the Academy of Sciences an account of the progress of the gigantic artesian well which M. Kind is sinking at the Bois de Boulogne, for the purpose of supplying the lake with water. The depth attained is 500 metres. On the 1st of May next it is expected that the depth of 700 metres will be reached. This is 152 metres deeper than the famous artesian well at Grenelle. When this depth is attained, it is calculated that the flow of water will equal that of the Seine under the bridge of La Tournelle, at Paris.

I now conclude the first division of my paper, my chief intention being to show the advantages of negative artesian wells for the various purposes of drainage, as well as to demonstrate in general the importance of extending the use of such absorbing borings in England, at the same time describing some recent actual operations of my own in Germany.

IRISH FISHERIES.

The Annual Report of the Commissioners for administering the Fishery Laws of Ireland, has just been issued, with an appendix containing the Report of the Inspecting Commissioners of Fisheries for 1855, a statement from the Royal Irish Fisheries Company, and a mass of correspondence and tables relating to this important subject.

It appears that the deep-sea fisheries are not in the prosperous condition which could be desired. As regards the inland or salmon fisheries, the Commissioners announce that they are progressing and rapidly improving, and that the Local Boards of Conservators are exerting themselves with zeal and success in carrying out the laws, which are generally approved. The Inspecting Commissioners in their report say that, notwithstanding they have had great difficulty in getting accurate returns, it is beyond question that the number of vessels and of men employed in the sea fisheries still continues annually to diminish. In the large fishery ports the demand for the navy and for the mercantile marine has operated to such an extent as to leave few but old and feeble men and young boys behind. Amongst the coast population who used occasionally to resort to the fisheries, the unusual rate of wages and the demand for labourers in the more certain pursuit of agriculture, has absorbed much the largest proportion; and the want of habitations upon the coast has prevented many persons from resuming their former occupations. This state of things has, in addition to an unusually unfavourable season, produced very high prices, the natural result of diminished supplies; and the metropolis, as well as the principal inland towns, have had reason to complain of great scarcity of fish since last autumn. This dearth of supply has been particularly marked on the whole line of coast from the river Kenmare, round southward and eastward, to Dublin, including the districts of Bantry, Skibbereen, Kinsale, Cork, Youghal, Dungarvan, Waterford, Wexford, and Wicklow. In the Dublin district it is said to have been better than last year, but from the coast of Louth round to the lough of Belfast the deficiency was considerable.

The extreme north and north-west of Ireland, including the shores of Antrim, Donegal, Sligo, and part of Mayo, were fairly supplied; while the shores and inlets between Erris Head and Slyne Head seemed to have been wholly deserted, and a better supply is reported to have been taken from Galway bay to the Durzey islands.

In the district of Galway, they report that the condition of the fishermen is improved; their boats and gear, generally speaking, are in good order; the take of fish is more regular and steady; considering the several methods of capture, the quantity of all kinds is larger than for years past, with the exception of herrings, and continues so. No conflicts of any kind have taken place, and the general habits of the fishermen are orderly and peaceable.

At Kinsale there was a greater want of men than of boats, most of the efficient hands having gone away, leaving only the old men and boys behind. The total dearth of herrings and other shoal fish was unparalleled, owing to which the want of bait was felt by the deep-sea fishers to a most deplorable extent. 5s. a gallon has been paid for sprats, and 3d. a-piece for herrings, for bait; and supplies for that purpose were brought from Bantry, from Dublin, and from the Bristol channel. The months of October, November, and December were unusually unfavourable; and ever since there have been nothing but northerly and north-east winds. The report from Kinsale winds up with the statement, that as many herrings have been taken in one night at other times as were taken for the whole of this year.

Attempts have been made to uphold the once flourishing fishery of Kinsale, but many difficulties have arisen, and no greater one than the practice which prevails among the fishermen's wives of depositing with the pawnbrokers the materials supplied to them for the manufacture of nets.

The want of bait in Kinsale is nothing new, and the establishment of great reservoirs of bait in the vicinity of our most important fisheries has been frequently suggested, but the Commissioners say that, notwithstanding the existence of the provisions of the 5th and 6th Vict., c. 106, passed especially for the encouragement of bait beds, they have not, in any single instance, being taken advantage of. They have frequently remonstrated with the people of Kinsale on this matter, but ineffectually. The question of an ample supply of bait for the deep-sea and long-line fishery is one of the most vital importance.

In speaking of the oyster fisheries, the Commissioners refer to the assurances they receive of progressive improvements generally in new beds that have been formed under the protection of licenses issued under the Act of Parliament, but they find that all the public beds within the estuaries and close to the shore are in rapid progress of exhaustion, from having been overworked, and in many cases from a total disregard to provident regulations. Oysters, so small as to be wholly unfit for use, are dredged, and instead of being returned to the beds, they are brought on shore; and when the oysters fit for use are culled, the small ones are thrown away and allowed to perish.

They have recently had ample opportunity of ascertaining that some of those sources of supply which were believed to have been inexhaustible, are diminishing so fast as to render it probable that they will soon cease to exist. Applications having been made to the Board for permission to dredge oysters during the month of May, for brood and planting, from the deep-sea banks in the Bay of Blacksod, in Achill Sound, and Clew Bay; meetings have been held at Westport, at Achill, and at Belmullet, and the result of the inquiry fully confirms the opinion that the banks are already overwrought. Unfortunately there appears to be a reckless disregard of provident habits in the many, and an unwillingness to interfere with the sources of employment in others. The subject demands immediate attention, and requires the application of some remedy.

The Commissioners refer to abstracts of the Reports in the Appendix from the Inspectors of Districts under the several Boards of Conservators, which exhibit a progressive improvement in the Salmon fisheries—the result of an organised system for the care and protection of the parent fish and fry, which is the main point to be relied upon in developing the resources of the inland or fresh waters of Ireland, which are so eminently calculated, by their extent and natural character, to yield an abundant harvest, if a provident principle be observed in sparing a sufficient stock for brood, and duly protecting that stock, when and where their seed is being distributed, which alone can ensure an ample return in reproduction.

The Commissioners urge this "oft-told truism" for the purpose of bringing under consideration some material points bearing upon the question of providing for a sufficient "sowing of the seed" throughout the rivers of the country. The most important and first in order is the question of close season.

Upon this point the Board are pressed by many parties to sanction changes suitable (as it is alleged) to the circumstances of different rivers—and, no doubt, the times at which salmon in good condition begin to ascend the rivers in Ireland, are variable; and they have recommended many modifications of the uniform principle provided by the Act 5 and 6 Vic., c. 106, and confirmed by the 9th and 10th Vic., c. 114; but they find great difficulty in satisfying the many conflicting parties concerned, whose opinions are often too much governed by local circumstances to permit them to take an enlarged view of the question at issue, with reference even to their own real interest. Thus, lower tidal fishers will advocate an early commencement, because they may take a few good fish in prime condition, and no doubt procure a high price; but overlooking the fact, that, at a short distance above them, at the same period, in narrower channels, hundreds of spent fish would be captured in a state of little, if any, worth, which, if allowed to escape, would descend to the sea, and in a few weeks return again in prime order, and of proportionately increased value, of which the lower captors would obtain the first fruits, far the largest share. To meet this difficulty, the Act 9 and 10 Vic., c. 114, provided an early commencement for the tideways, and a later for the fresh waters, one month being the period of difference; but the Board find that this arrangement has not been successful in allaying discontent, the upper fishers complaining that an undue restriction was placed on them, solely for the benefit of one class, who, they maintain, should forego a portion of the early fishing, if it be an object to prevent the capture of spent fish above, which, if spared, would descend, and first fall into the lower nets in a state of increased value. In four important districts—Cork, Waterford, Killarney, and Limerick—the Board have sanctioned the rescinding of this principle of distinction between tidal and fresh waters in the commencement of the open season, with the almost unanimous concurrence of the several parties interested; but it is with regret that the Board find that vast quantities of spent fish have been captured during the early portions of the two last seasons, and that too many persons who fish in the upper or fresh waters, and some in the tideways, have, as reported, systematically sought to take and kill them, when it might be avoided, and means easily adopted to enlarge those fish without injury. If a few, or even a considerable number of spent fish were sacrificed, it might not be much matter, because they have performed the important office of sowing the seed; but wholesale destruction, such as reported to us from some localities, must, if continued, materially diminish the value of the fisheries. But, recurring to the question of providing for a sufficiency of "seed to sow the ground," a main point must be to retain a number of fish adequate to the object, and this can only be effected by "*closing early.*" The Board have been pressed from many quarters to extend the time of fishing at the end of the season, and they have yielded in some instances to a certain extent, more for the purpose of allowing an experiment to be made by the persons interested, where unanimity prevailed on their parts, than from any confidence on the part of the Board that it was expedient; because the Board have found in many cases a disposition to reject all theory, no matter how well supported by analogous facts, and that nothing short of practical experience can convince the generality of local salmon fishers that a general rule is applicable to the river in which they fish. Under such circumstances, the Board appear to have been induced to sanction some changes in a direction not in accordance with their own views, as a power exists to rescind such regulations, if they should be found not suitable, after a lapse of three years. An argument is often pressed to justify an extension of the fishing season, which in many instances the Board do not admit to be well founded; namely—that because the fish may be in good marketable condition at a certain season in certain localities in the latter part of the year, that, therefore, they should be taken, and that it is a waste not to do so. It so happens, however, that the fish in many tideways "hang" in them, as the term is, and do not seek to ascend the rivers until late in October, or November; and under such circumstances, if the season be extended, nearly the whole of those fish may be taken, and the rivers left barren for want of spawn; so that the question is not, whether the fish be in good or bad condition, but whether a sufficient stock will be left for brood in the upper waters, and it should be remembered that the means of capture in the sea and tideways have been greatly increased within latter years, and improved skill has been called into action by the enhanced value of the article sought for, and that hence, unless the time of capture be duly limited, the waters generally may be "fished out," as in some instances they have been, where uncontrolled capture has been injudiciously permitted, and practised.

The next point bearing upon the stocking of the upper waters for brood, is providing passes over obstructions. This object has been well effected in many instances, and applications continue to be made for such constructions; but the progress of affording means for the upward passage of fish is much too slow, when it is considered how materially the full development of the salmon fisheries is retarded thereby. In many places barriers now exist, where fish cannot pass; in others, the heavy autumn fish are detained too long by the difficulty of ascending in their then unwieldy state, and great deficiency in supplying the spawning grounds is the consequence. It has been suggested by many, that, to effect without delay a general provision of passes throughout the important rivers, it would be desirable to provide for the obtaining of advances of money for this object, to be repaid by instalments out of the funds derivable from licence duties; but the difficulty is to propose a source from which such loans might be obtained. Two objects should be held in view by those interested with respect to migratory passes; first, the all-important one of allowing the brood fish to ascend in autumn and winter to the spawning fords; secondly, to allow a fair proportion of fish during the spring and summer months to reach to the upper proprietors, who are equitably entitled to their share, and it is the interest of all below to yield it, for the purpose of securing their co-operation in protection during close seasons, and thus stimulating their zeal by securing them some participation in the advantages to be derived.

The Commissioners report that the experiments commenced in reference to the artificial propagation of salmon continue to be followed up by several, who laudably persevere in endeavouring to render it applicable, on a large scale, for general advantage, and the progress of their operations is watched with much interest. Much must depend upon the proper management of the young fish up to the time of their enlargement from the artificial ponds, and the Commissioners are of opinion that they should not be detained very long. Many communications have been received from Perth, reporting the progress there, all of which seem to promise success. Indeed, so far as capturing some of the marked fish, which had attained a large size after their first visit to the sea, it may be said that success has been realized, but it yet remains to be proved to what extent the commercial value of the salmon fisheries may be increased by such means, beyond that which arises from the ordinary operations of nature.

The success of the models of fish ladders, exhibited in Dublin in 1853, in attracting attention and promoting their adoption, has been followed by an interest created in Paris, at the Exhibition of 1855, even exceeding the former. Crowds daily attended to witness the exhibition of their use by the little fish ascending. All classes, and the people of all nations, were attracted by them. The Emperor and Empress of the French, as well as the crowned heads of other countries, expressed their approbation of this valuable contrivance; and the International Jury awarded two medals in consideration of their merits, as applying to so important an object as the cultivation of the inland or fresh waters of all countries, possessing such sources of commercial value, if duly appreciated and managed with judicious care. Persons from Canada obtained plans and drawings of the models, with the view of adopting them in that country, where it it is found that the increased erections of weirs, for the purpose of obtaining water-power to work sawing mills, has considerably interfered with the salmon fisheries, in some localities, by obstructing the ascent of the fish.

The following extracts, from the Report of Mr. Brady, who had charge of the models in Paris, will more fully explain the success of the exhibition there; and the Board feel bound to state, that Mr. Brady deserves much credit for the manner in which he arranged and conducted all the matters entrusted to his care, and that they are indebted to him for much valuable and interesting information relating to inland fisheries which he collected while in France:—

Extracts from Mr. Brady's Report.

"Amongst the models sent to Paris by the Board were—

"A working model of a design for a fish passage over a mill weir, without injuring the water power of the mill, by William Forsyth, C.E.; and a working model of the regulating weir, with fish passage, erected by the Commissioners of Public Works, on the river Corrib, at Galway.

"These were the most attractive models of all that had been sent over. All were arranged in their proper places, and the department in fair order by the 15th of May, the day on which the opening of the Exhibition took place.

"Immediately after that ceremony tradesmen were employed to connect the models with leaden pipes, and adjust them fairly, to prepare for the water passing through them, and for the reception of the young fish.

"As soon as this had been completed, the department was assailed by numbers of persons who recognised the models, as having seen them in the Dublin Exhibition, and were daily inquiring when the young fish would be placed in them, to illustrate the working of the fish ladders.

"It was, however, some time before the necessary supply of water could be procured, and when this was accomplished, the next object was to try and get some young trout, or other migratory fish, which would, by instinct, ascend the ladders against the current of water running down the fish passage. Here, again, was experienced great difficulty, as the laws against any mode of fishing in the fresh waters in that department of the empire, before the 15th June, are very stringent; and, indeed, even after that date, it would have been both difficult and expensive to get such fish as were required, there being very few trout in the river Seine, and no salmon, had it not been for the kindness of M. C. Millet, Inspecteur des Eaux et Forets, who took a very lively interest in the good working of our models, and procured a quantity of artificially bred minnow, trout, salmon, and gudgeon. M. Millet has devoted a great deal of time to the artificial propagation of fish of every species, both sea and river. He has some excellent apparatus for breeding fish, and furnished a vast deal of information on this subject, and the fisheries of France in general. The Board are really greatly indebted to this gentleman for his exertions.

"The fish were not in the models many days before the department was honoured with a visit from the Emperor and Empress and suite, who remained for such a length of time that it caused no little jealousy amongst other exhibitors. The Emperor asked a great number of questions, and entered fully into conversation on the subject of the Irish Fisheries.

"On leaving the department the Emperor said he was much pleased with all he had seen and heard, and was obliged, and the Empress said they 'should pay another visit.'

"From this time forward the department was, if possible, more crowded by visitors than ever, all eager to get a peep at that exhibition which detained their Majesties so long, and there was but one feeling of pleasure at what they had seen in the models. It would be tedious to attempt to repeat the various expressions of gratification which were made use of by almost every one who visited the department; sufficient to say, the excitement and the crowds of people became so great, that it was necessary to get up a strong rail round the models to protect them from the pressure of the crowd.

"The fish ladder or passage was there quite unknown, or at least, if known, had not been adopted in France, and, therefore, was a subject of great curiosity and interest with scientific men, and it is likely that it will be immediately adopted on the weirs in the rivers in France. The Canadian Commissioners were much attracted by them, and took plans of the fish passes, &c., with a view of having them brought into operation in that country, where it appears they may be much required to enable the fish to overcome weirs which have been erected for the purpose of obtaining water-power to work saw-mills in that land of forests.

"The original inventor, or, rather discoverer of the means by which salmon might be enabled to overcome difficulties either natural or artificial, in their proper element, was at the Exhibition.

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"I visited the College de France, in Paris, where artificial propagation of fish is carried on to a large extent, and has been for a considerable time. I met Monsieur Coste, and saw in his breeding apparatus about 400,000 young salmon and trout, about two months old. I also saw there, in ponds, several salmon weighing from two to three pouuds each, and upwards; these fish had never been afforded the opportunity of descending to the sea, but were confined in ponds, and regularly fed; though they had attained this weight, they were lank, ill-shaped fish, exhibiting the deficiency in condition, in consequence of their continued confinement in the fresh water, and restraint from their natural migration to the sea.

"I also witnessed the mode of fishing on the Seine, and saw a large capture of eels. The fish, particularly the eels, were remarkably good and large; but the modes of capture inferior to ours.

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"In conclusion, I beg to say, the models, and the young fish, created a greater interest than any other department in that Exhibition where the products of the world were introduced, and which was acknowledged by the resolution of the British Jurors of the 2nd of July, to have excelled that of 1851; and a greater evidence of this truth cannot be adduced than the distinguished honours that have been awarded to the Commissioners —first, by the International Jury awarding two medals, and next by the election of the Chairman and Secretary to the high position of honorary members of the Imperial Société Zoologique d'Acclimitation.

"THOMAS F. BRADY."

The principle of fish passages over weirs in rivers was first introduced by the late William Smith, Esq., of Deanston. The following is an extract from a letter received from his cousin, Mr. James Buchanan, of Glasgow on the subject:—

Extracts from Mr. Buchanan's Letter.

"As it may interest you to know something of the origin of the first salmon stairs, I give you the following particulars, which will show that the salmon was itself the originator of the idea. The winter of 1827 saw the Deanston dam completed. Mr. Smith left about ten feet next the flood-gates lower by about thirteen inches, expecting that as the water would always be deepest there, if any were coming over the dam at all, the fish would easily find their way up, more especially at night, and when the works were stopped. He had gone to Manchester just as it was finished, before any fresh had occurred to flood the river, and cause the fish to run up to the spawning grounds above. In the unfinished state of the dam the fish had congregated in great numbers below it, till, a part giving way, a gap was made by which they were enabled to get up through the broken water into the dam itself. After Mr. Smith had been gone a few days only, there occurred a flood in the Leith, and you may judge of my chagrin and annoyance to find that no fish could stem the current in the intended salmon race more than about one-third only of the whole length, so that all were swept back by the current as they made the attempt. Hundreds were in the deep water at the tail of the dam, apparently worn out by their fruitless efforts to ascend, or perhaps were naturally more tame at that season, for they allowed my approach to the bank without moving away. I had placed two large flat stones in the current, a few feet upwards from the deep water, to enable me to stand and examine the fish as they lay; all at once a fine large one sprang up into the broken or dead water caused by my stepping stones, and lay there, apparently at its ease. The thought then struck me to lay another retarder to the overpowering stream, a few feet higher up. In a few minutes the same fish, without my losing sight of him, sprang up to this second place of rest. As plenty of large iron spikes, used in the construction of the wood-works of the dam, were at hand, I drove two, at about three feet separate, into the seams of the stone about the same distance up on the opposite side of the run, and laid a bit of board, a few feet long and about twelve inches broad, against them; the rush of water downwards held it against the nails. In a short time the fish was up and in the broken water. I now placed nails in a similar way, and a board, in the opposite side, to which he sprang. With two bits of board changed from one set of nails to the other, he worked up till about within a third of the ascent, when, apparently as if knowing its own powers, it made a spring out of the run and ran up the slope of the dam into the deep water within. I lost no time in getting boards placed at each set of nails, so that before it was too dark to see how matters went on, I had the satisfaction to perceive many a fine fish over in safety. By next morning none were to be seen, and but at a very chance time afterwards below the dam.

"As this frail ladder was frequently swept away, on Mr. Smith's return, a few weeks afterwards, he had short pieces of log, about six by twelve inches deep and six feet long, bolted firmly to the stone. It was curious to remark how far each fish, according to his strength, made use of the ladder before he ventured to spring over into the dam itself. I have certainly seen a few fine fish go up the ladder to the top and glide slowly into the dam without ever attempting to leave the run itself. It was rare that any fish left the ladder before he got so high up as to be able to reach the breast of the dam in safety. I have seen a few miscalculate their strength, and roll down either into the lower part of the ladder run or quite into deep water at the foot; but this was always the exception.

"JAMES BUCHANAN."

The statement received from the Royal Irish Fisheries Company shows that, though a tolerable profit has been made by the trawlers, the season has been a very indifferent one, owing principally to continued calms and light easterly winds. In the corresponding months of previous years more fish was taken with only two vessels. The Company say, "A heavy gale from the south-west, now that the turbot and dorey are coming in, would more than double our profits." January being generally the month in the worst year, the two largest vessels, then recently purchased, were not fitted out until the end of the month; a profit, however, having been made by the others, the accounts do not show all that might have been realised had the whole fleet been fishing from the commencement of the year.

The masters of the six first-class vessels get £1 6s. per week, besides a gratuity of 5 per cent. on the profits. They are all thorough seamen and skilled fishermen. They are all obliged to keep a log, detailing the particulars of each day's work, wind and weather, the fish taken each day, and any remarkable occurrence; and must send a copy of it, with their account, to Dublin weekly, through the hands of the agent of the station, who certifies that the fish has been duly received and forwarded, and that their sailings and arrivals have been correctly stated. So regular are they in making these reports, that for years past they have not been known to fail; and during the last four months in only two instances have the Company found them even one day late. The mate—it is optional with the master to have one or not—receives £1 per week wages; and the men before the mast—natives, with scarcely an exception, of the west coast—get from 10s. to 12s. weekly; all may use as much fish of any kind as they please, on board; they are supplied with fuel and candles—in other respects they find themselves. During the very hot weather in the middle of summer, the price of fresh fish will most likely fall. The vessels can, however, then be profitably employed in the deep-sea line fishing, or in buying herrings in any port where they may be largely taken.

Galway is maintained more as a central station, and for the sake of the trawlers, than from any profit the Company derive from curing fish there. It is situated too far in the bay for curing ling; and since the railroad was opened herrings bring too high a price for barrelling, unless a very large quantity be taken, for which they are fully provided. There is a large and daily increasing demand for prime fresh fish there, and arrangements are making to supply Ballinasloe, at the request of some of the principal inhabitants. If this arrangement be found satisfactory, other towns, both on the Midland and South-Western Railway, will be supplied.

The statement shows a profit to the Company of £437 for the four months ended April 26, 1856.

The quantity of fish conveyed by the Great Southern and Western Railway for the year ending 31st December, 1855, was three hundred and eleven tons.

The rates of carriage of fish on the Great Southern and Western Railway were—

Salt Fish	1·909d. per ton per mile.
Fresh Fish	4·755d. ,,

The quantity of fish conveyed by the Midland Great Western Railway for the year ending 31st December, 1855, was—

	Tons.	Cwts.	Qrs.
Salmon, turbot, &c................	82	13	0
Lobsters............................	94	11	3
Cod, hake, plaice, &c.............	299	0	1
Oysters	166	5	1
Gross..............	642	10	1

The rates of carriage of fish by Midland Great Western Railway were—

Salmon, turbot, &c............	46s. per ton
Lobster	46s. ,,
Cod, hake, plaice, &c.	30s. ,,
Oysters	29s. ,,

THE PATENT LAW.

In the House of Lords, on Friday, the 25th of July, Lord Lyndhurst wished to ask his noble friend upon the woolsack if it was his intention to introduce any measure during the next session to amend the law relating to patents.

The Lord Chancellor said that the subject was so beset with difficulties that he could not make any pledge, but it would receive his most careful consideration.

DECAY AND PRESERVATION OF STONEWORK.

In the House of Lords, on Friday, the 25th of July, Lord Lyndhurst presented a petition from John Benjamin Daines, setting forth that he had invented and patented an improved and effectual mode of preserving stone, plaster, cement, and other buildings from decay, indurating and protecting them from atmospheric influences, and neutralising the tendency to alkaline efflorescence,* the efficiency of which, the authorities had declared, would be decided upon in two years. That the invention had been submitted to competition with other processes, claiming to have similar virtues, upon the New Palace at Westminster, and was the only one that had succeeded. The petition went on to pray, the petitioner having been informed that certain decaying and deleterious influences had already been at work on portions of the New Palace at Westminster, that the House would inquire into the truth of these allegations; and, if satisfied with the results of such inquiry, that it would accept the use of such patented invention for national purposes. He had himself seen a report from Sir C. Barry, which stated that the result of the invention, which had been tested upon 1,400 square yards of the house, had been entirely satisfactory. Under these circumstances, he begged to ask her Majesty's Government if they were prepared to appoint a committee to inquire into the matter.

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* A description of this invention appeared in the *Journal*, No. 191, p. 604.

The Earl of Harrington thought it was too late in the session to appoint a committee.

Lord Lyndhurst said that portions of the stone-work were already beginning to decay, and no time ought to be lost in taking some step to prevent the continuance of that decay.

Home Correspondence.

MR. HAWES' THEORY OF SAPONIFICATION.

Sir,—I send you a specimen of retro-glycerine, made from stearine by direct decomposition, and converted into an oil by a process I have devised. M. Bertholet is the discoverer of a retro-glycerine oil, which he announced to the Academy of Science, at Paris, some years since. I do not know his process, but I have every reason to believe that it can differ very little from that I employ, for the two oils support a great degree of refrigeration; they evince the same properties under the action of light, in regard to polarisation, refraction, &c. This oil produces a most perfect soap, and produces a very white light when in combustion.

I shall send a larger sample in a short time, and shall examine and give its elements, and also ascertain if the glycerine produced from the decomposition of oleine produces the same oil as that produced from stearine.

I am, &c.,
P. C. JENNINGS.

16th July, 1856.

INDURATING MARBLE OR STONE.

Sir,—Mr. Page's process will undoubtedly meet with success. Canova, the great sculptor, always recommended what he called the encaustic process, when his works were to be exposed in the open air; that is to say, melt pure wax in a clean ladle, and with a soft brush cover the marble with two or more coats. When perfectly congealed, hold a red-hot iron plate just so near as to cause the whole of the wax to sink into the marble. Stone or marble thus treated will never lose its colour, and, if white, will remain so. If the stone or marble should become soiled with dirt and smoke, it may be easily washed without the slightest injury. This encaustic process is applicable to both stucco and plaster casts, which latter may then be freely exposed to the weather with perfect safety. It is strongly recommended by Vitruvius, Pliny, and other old writers on such subjects, and is one of the secrets of the long preservation of the painted decorations of the cities of Pompeii and Herculaneum.

Previous washings with clear alkaline solutions will of course destroy all traces of grease, which is highly injurious.

I am, &c.,
HENRY W. REVELEY.

Proceedings of Institutions.

Whitehaven.—The half-yearly general meeting of the members of the Mechanics' Institution, for the election of officers and the transaction of general business, was held in the Lecture-room, Queen-street, on the 21st of July. The attendance was not so large as might have been anticipated, and the chair was taken *pro forma* by the president, Mr. Smith, who opened the proceedings by a short exposition of the mode of conducting the election. The Secretary then proceeded to read the report, which was unanimously adopted. The report commenced by expressing the pleasure experienced by the Committee at the prosperous state of the Institution, the number of members at present being 306, which shows an increase of 30 on the half-year. A classification of the members shows the following results:—17 honorary, 190 ordinary, 88 apprentices, and 11 ladies. To the library the Committee have devoted considerable attention, and that important adjunct to an educational institution has been greatly extended and improved. Forty-eight new volumes have been purchased through the Society of Arts, and among the additions are some very important works. In the early part of the half-year classes were in operation for instruction in drawing and geometry, and the French and German languages; but with the exception of that for drawing, their operations have been suspended during the summer months. A discussion class, which was in existence during winter, had also suspended its meetings. The report also stated that Mr. William Cape had announced his intention to offer his services gratuitously to conduct a class for instruction in English grammar. From the statement of accounts it appeared that the receipts of the half-year, notwithstanding a considerable extraordinary outlay on the library, exceeded the disbursements by £5 14s. 6d., which amount is carried to the credit of the ensuing half-year. The receipts altogether amounted to £54 15s. 7d., and included £42 15s. as subscriptions of members, and £9 15s. 9½d. as the profits on the annual *soirée*, in January. The election of officers was then proceeded with, Mr. J. C. Brown being elected president in place of Mr. Smith, and the following gentlemen elected members of the Committee of Management in place of a like number who retired by seniority:—Messrs. Wm. Smith, William Elliott, John Jackson, Thomas Hannah, C. H. Davis, and the Rev. W. Lyde. Mr. S. Armstrong was re-elected Secretary, and a vote of thanks was unanimously awarded to him for his past services. Librarians were also appointed, and the proceedings terminated with announcing the result of the election of the president and members of the Committee, as given above.

To Correspondents.

Erratum.—Last number, p. 610, col. 2, line 11 from top, for "Kopaĕs" read "Kopäis;" in same column, in note, line 2, for "der" read "den;" same column, same note, last line but one, for "1855" read "1835;" p. 611, line 7, col. 1, insert "near" between "on" and "or;" p. 612, col. 1, line 23, for "Amterhausen" read "Amtenbausen;" same page, col. 2, line 35 from the bottom, insert "to" between "waters" and "sink;" in line 9 from the bottom, for "1820" read "1840;" and last line but six, after "beds" *dele* (").

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 19th and 21st July, 1856.

320. Poor Law (Ireland)—Returns.
347. Civil Contingencies—Account.
367. Burial Acts—Lords' Report.
368. Public Offices—Report from Committee.
333. Metropolis Turnpike Roads—Report from Committee.
363. Standing Orders Revision—Report from Committee.
264. Bills—Dulwich College.

255. Bills—Stoke Poges Hospital.
256. Bills—County Courts Acts Amendment (as Amended in Committee, and on consideration of Bill, as Amended).
257. Bills—Parochial Schools (Scotland) (Lords' Amendments).
258. Bills—Commissioners of Supply (Scotland) (Lords' Amendments).
259. Bills—Dwellings for the Labouring Classes (No. 2) (Ireland).

Delivered on 22nd July, 1856.

331. Medical Department (Army)—Report from Committee.
338. Education (Manchester)—Copy of Correspondence.
360. King's Inns (Dublin)—Return.
361. Unity Joint-Stock Mutual Banking Association—Copy of Case and Opinions.
369. Ecclesiastical Commission, &c.—3rd Report from Committee.
374. New Palace at Westminster—Copy of Further Treasury Minute.
260. Bill—Proctors in Ecclesiastical Courts.
Criminal Offenders (Scotland)—Tables.

Delivered on 23rd July, 1856.

348. Public Income and Expenditure (Balance Sheet)—Account.
377. Bishops of London and Durham—Copies of Correspondence.
261. Bills—Hay and Straw Trade (Amended).
262. Bills—Metropolis Local Management Act Amendment (Lords' Amendments).
263. Bills—Oxford College Estates (Lords' Amendments).
264. Bills—Bishop of London and Durham Retirement.

Delivered on 24th July, 1856.

327. Juvenile Offenders (Ireland)—Return.
351. Imports and Exports (Australia, &c.)—Return.
265. Bills—Formation, &c., of Parishes (Lords' Amendments).
266. Bills—Sheep, &c., Contagious Diseases Prevention.
Army—Report of the Board of General Officers.

Delivered on 25th July, 1856.

365. Coinage—Account.
370. National Vaccine Board—Annual Report.
371. Stipendiary Magistrates—Return.
373. Brewers, &c.—Return.
389. New Westminster Bridge—Report from Committee.
391. Belize—Copy of a Letter.
356. Oxford University—Copies of Orders in Council.
French Military War Medal—Names of Non-Commissioned Officers and Soldiers selected for recommendation to the Emperor of the French.

Delivered on 26th July, 1856.

39(6). Trade and Navigation Accounts (30th June, 1856).
385. Racehorses—Return.
380. Sound Dues—Report from Committee.
368. Public Offices—Report and Minutes of Evidence.

Delivered on 28th and 29th July, 1856.

372. County Courts—Return.
386. Petitions for Private Bills—Return.
401. Hampton Court and Kew Gardens—Return.
366. Capital Punishments—Lords' Report.
Prisons—19th Report of the Inspectors (Home District) Part 1.
Public General Acts—Caps. 55, 56, 57, 58, 59, 60, and 61.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette July 25th*, 1856.]

Dated 20th June, 1856.

1454. Alexander Sands, Manchester—Improvements in apparatus for signalling and for saving life and property at sea, part of which is applicable to signalling on land.

Dated 24th June, 1856.

1482. Joseph Harrison, Blackburn, and Christopher Gelderd, Lowmoor, Clitheroe—Improvements in looms for weaving.

Dated 26th June, 1856.

1504. David White, 3, Winchester-place, Clerkenwell—Improved apparatus for the more perfect combustion of gases, for preventing their escape, and the unnecessary radiation of heat therefrom.

Dated 8th July, 1856.

1600. Rev. George Bradshaw Watkins, Godmanchester—Improved apparatus for obtaining infusions or extracts from various substances.
1601. William Youtman, Southampton—Improvements in valves and plugs.
1602. Joseph Henry George Wells, 45, Essex-street, Strand—Improvements in pistons for steam and other motive power engines and pumps in general, and which improvements are also applicable to stuffing boxes. (A communication.)
1603. Joseph Henry George Wells, 45, Essex-street, Strand—Improvements in governors or regulators. (A communication.)
1604. Frederick William Hoffman, New York, U.S.—An improvement or improvements in breech loading fire-arms.
1605. Henry Page, Whitechapel-road, Middlesex—Improvements in ornamenting or decorating glass.
1606. Julien François Belleville, Paris—Certain improvements in generating and applying steam.
1607. Robert Martineau and Brooke Smith, Birmingham—Improvements in taps for drawing off liquids.
1608. Alfred Vincent Newton, 66, Chancery-lane—Improvements in repeating fire-arms. (A communication.)
1609. Alfred Vincent Newton, 66, Chancery-lane—An improved fountain pen.—(A communication.)
1610. Abraham Herts, 22, Bunhill-row, Finsbury—An improved sheet metal bending and tubing machine. (A communication.)
1611. Alexander Gray, Glasgow, N.B., and John Rawson, Bury, Lancashire—Improvements in means or apparatus for lubricating.
1612. Louis Bayer, Soho, London—An improved stuffing to be used in place of hair or other substances in which such articles are commonly employed.
1613. Sewall Short, New London, U.S.—Certain improvements in horse shoes and shoes for other animals.
1614. Henry Pigott, Glasgow—Improvements in hats and other coverings for the head.
1615. David Fisher, 12, Ranelagh-road, Thames Bank—A composition for coating metal, plates, or wheels, used for grinding, sharpening, or polishing.

Dated 9th July, 1856.

1616. William Bridges Adams, 1, Adam-street, Adelphi—Improvements in railway wheels, axles, and axle boxes.
1617. Alfred Krupp, Essen, Prussia—Improvements in the permanent way of railways.
1618. Rudolph Bodmer, 2, Thavies-inn, Holborn—Improvements in self-acting apparatus applicable to certain kinds of machines for spinning cotton and other fibrous substances. (A communication.)
1619. George Darlington, Kingston, Jamaica, and John Darlington, 36, Cannon-street, London—Improvements in the manufacture or production of zinc or spelter.
1620. Ward Holroyd and William Noble, Queen's Head, near Halifax—Improvements in machinery or apparatus for cutting wood and stone.
1621. Daniel Webster Hayden, Glasgow—Improvements in fastenings for window shutters.
1622. Timothy Jerome, 125, Great Hampton-street, Birmingham—Certain improvements in buttons for ornamenting and fastening dresses, as also in loops for attaching or holding buttons on garments while in use.
1623. Alexander William Williamson, London University, Gower-street—Improvements in obtaining the rosin and sugar of scammony.
1624. William Robertson, Manchester—Improvements in machines for spinning and doubling cotton and other fibrous substances, such machines being of the kinds commonly known as mules and twiners or doublers, and in the means of weighting rollers in the same and other machinery.
1625. Edward Wilson, 12, Eccles-street, Dublin—Improvements in pistons for steam engines driven by steam or any other elastic fluid, which improvements are also applicable to the pistons or plungers of pumps.
1626. Moss Defries, Houndsditch—Improvements in moderator and other lamps.
1627. Richard Dugdale Kay, Accrington—Improvements in machinery or apparatus for pressing, straining, sifting, or refining colours and thickened mordaunts. (A communication.)
1628. Robert Thomas Eadon, Sheffield—An improvement in the manufacture of band saws and other endless bands or hoops of metal.
1629. Henry Adcock, City-road—An improvement in casting iron and other metal.

Dated 10th July, 1856.

1630. Frederic William Russell, Aldgate, London—Improvements in the mode of coupling railway carriages.
1631. John Marsh, Nottingham, and John Catt, Stepney, Middlesex—Improvements in the manufacture of certain textile fabrics.
1632. Paul Prince, Derby—Improvements in making moulds for casting railway chairs and other articles.
1633. Samuel Hardacre, Miles Platting, Lancashire—A compound conical spike and spiral double gridded machine for opening, blowing, scutching, and cleaning cotton, wool, and other fibrous substances.
1634. Charles William Lancaster, New Bond-street—An improved method of, or apparatus for, inking, printing, or stamping surfaces. (A communication.)
1635. John Fowler, junr., Havering, Essex, and William Worby, Ipswich—Improvements in machinery for ploughing and tilling land by steam.
1636. Stephen Martin Saxby, Rock Ferry, Cheshire—Improvements in ascertaining the errors of mariners' compasses.

Dated 11*th July*, 1856.

1637. Robert Hutton Leadbetter, Glasgow—Improvements in the preparation of flax.

1638. Robert Harrington, Witham, Essex—Improvements in umbrellas, parasols, walking sticks, whips, &c.

1639. John Westwood, Lichfield-street, Walsall—Improvements in hand, roof, and other railway lamps, parts of which are also applicable to certain descriptions of oil lamps for general purposes.

1640. Thomas Charlton and William Turnbull, Brentwood, Essex—Improvements in steam generators.

1641. General Henri Dembinski, Rue Joubert, 8, Paris—An apparatus giving a self-acting motive power, produced by weight, elasticity, compressed water, or any gas whatever.

1642. Jean Baptiste Désiré Chevalier and Narcisse Rabouin-O'Sullivan, Paris—A new or improved method of obtaining or preparing printing surfaces, and in printing therefrom.

1643. Edward Henry Cradock Monckton, Parthenon Club, Regent-street—The application of a means or process for destroying grubs and other insects or animalculæ, or infusoria injurious to plants.

1644. Alfred Nicholson Wornum, Store-street, Bedford-square—Improvements in grand pianofortes.

Dated 12*th July*, 1856.

1645. Benoit Frederic Ortet, 39, Rue de l'Echiquier, Paris—A new metallic composition applicable to the coating of surfaces, and to the moulding and casting of various objects.

1646. Thomas Madely Hartwell, James William Gladwin, and Henry Gladwin, Manchester—Improvements in machinery or apparatus for stretching woven fabrics.

1647. William Bridges Adams, 1, Adam-street, Adelphi—Improvements in the permanent way of railways.

1648. John Pope, Wincheap-street, Canterbury—Improvements in the application of steam power to ploughing and other agricultural purposes.

1649. William Petrie, Woolwich—A new porous material for filters and other like articles, and for certain modifications or improvements in the manufacture of the material whereby it is adapted to the formation of vessels of capacity, to be employed as a cement, as a water and acid proof lining, as a preservative coating, and as a substitute for stone and earthenware.

1650. Abraham Herts, 22, Bunhill-row, Finsbury—Improved apparatus for holding material during the operation of sewing. (A communication.)

1651. John Avery, 32, Essex-street, Strand—An improved "plate-holder" for photographic and other purposes. (A communication.)

1652. John Rowley, Camberwell, Surrey—Improvements in the manufacture of a material as a substitute for leather.

Dated 14*th July*, 1856.

1653. Pierre Beauplant Rassant, Paris—A new mechanical contrivance for transforming an alternate into a continuous circular motion.

1654. Charles Burrell, St. Nicholas Works, Thetford—Improvements in arranging and rendering portable apparatus suitable for distilling from beet root and other vegetable substances. (Partly a communication.)

1655. Richard Dendy, Hornchurch, Essex—Improvements in horse-rakes.

1656. Alfred Vincent Newton, 66, Chancery-lane—An improved mode of securing the plastering of ceilings and walls.—(A communication.)

1657. William Williams, Dale, Pembrokeshire—Cutting and dressing stone by machinery.

Dated 15*th July*, 1856.

1659. William Edwards, Salford—An improvement or improvements in lathes, applicable also in part or on the whole to tools for boring, shaping, cutting, and screwing metals.

1660. William Clibran and Joseph Clibran, Manchester—Improvements in apparatus or mechanism for regulating and measuring gas.

1661. William Watt, Belfast—Improvements in the manufacture of starch.

1662. Evan Leigh, Manchester—Improvements in the mode or method of generating steam and applying it for the purpose of obtaining motive power. (Partly a communication.)

1663. John Knowelden, 3, South-street, Southwark-square, Southwark—Improvements in apparatus for preventing steam boiler explosions.

1665. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for consuming smoke to be applied to lamps and gas burners. (A communication.)

1666. Charles Bell Blyth and William Parell Butchart, Dundee—Improvements in weaving.

1667. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Surrey—Improvements in pumps. (A communication.)

Dated 16*th July*, 1856.

1671. James Ford, Preston, and Peter Knowles, Bolton-le-Moors—Improvements in machinery for cleaning and preparing cotton and other fibrous substances.

1673. Richard Morgan, Acton, Middlesex—A pocket-case for containing address cards, stamps, and other similar articles.

1677. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in circular looms. (A communication.)

1679. Adolphus Frederick Gurlt, 40, Newington-place, Kennington—Improvements in the manufacture of iron and steel.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1688. Francis Barber Howell, Lebanon, Ohio, U.S.—Certain improvements in machinery for making corks. (A communication.)—18th July, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 25th, 1856.

207. Alexis Jean Dessales.
213. Patrick Doran.
227. Pierre Emmanuel Guérinot.
259. James Mash.
275. George Holcroft, Joseph Smith, and Thomas Holcroft.
283. James Timmins Chance.
290. John Rock Day.
298. Ralph Waller.
322. John Inshaw.
353. William Henry Zahn and Joseph Henry George Wells.
479. Charles Iles.
495. George Parry.
497. George Tomlinson Bousfield.
897. William Smith.
933. Peter William Barlow.
948. James Nasmyth and Herbert Minton.
1003. Claude Antoine Arnaud.
1065. William Edward Newton.
1211. Charles De Jongh.

Sealed July 29th, 1856.

246. Auguste Mathieu-Maurice De Bergevin.
254. John Lee Stevens.
265. Henry Render.
272. Matthew Ker.
280. Francis Best Fawcett.
281. Henry Bestwick and Joseph Bury.
286. Charles Catherine Joubert and Leon Andre Bordier.
292. Benjamin Burleigh.
295. Alexandre Tolhausen.
314. Alexander McDougall.
332. William Kenworthy.
337. Thomas Restell.
352. Christophe Muratori.
379. Stephen Rossin Parkhurst.
390. Edouard Deiss.
392. Alexandre Tolhausen.
396. Eddlestone Elliott, Cyrus Leach, and James Sutcliffe.
456. James Griffiths.
474. Louis Normandy.
525. William Crozier.
678. John Jones and Alexander Cunningham Shirreff.
786. John Gray.
787. Alfred Vincent Newton.
922. William Westley.
1111. John Ridal.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

July 21st.

1730. Alexander Isaac Austen.
1740. James Murdoch Napier.
1748. Warren de la Rue.
1967. Benjamin Hornbuckle Hine and Anthony John Mundella, and Thos. Thompson.

July 22nd.

1733. George Spencer.
1741. Samuel Barlow and John Pendlebury.
1791. Philipp Schafer and Frederick Schafer.

July 24th.

1758. Thomas Buxton.

July 25th.

1760. Joseph Barrans.
1772. Benjamin Collins Brodie.
1827. George Ferguson Wilson and Alexander Isaac Austen.
1907. Joseph Leon Talabot and John Davie Morries Stirling.

July 26th.

1766. Peter Armand le Comte de Fontainemoreau.
1771. Thomas Forster.
1780. George Katz Douglas.
1793. John Shae Perring.
1824. Richard Brown Roden.
1935. Peter Fairbairn.
2187. Alfred Vincent Newton.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3863	July 29.	Wasteless Water-Valve and Ball-Tap Apparatus	William Devon and George Saunders	Stratford, Essex.
3864	„ 29.	Water-tight Spindle Bearing	Richard Waygood	Newington Causeway.

Journal of the Society of Arts.

FRIDAY, AUGUST 8, 1856.

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ASSISTANT-OBSERVER AT KEW OBSERVATORY.

The managers of the Kew Observatory, having applied to the Council of the Society to recommend to them one of their candidates at the late examination, qualified to undertake the duties of Assistant-Observer, the Council have nominated Mr. Charles Chambers, of Leeds, who has, accordingly, been appointed to the office.

Mr. Chambers obtained a certificate of the first grade in Mathematics, at the examination held in June last.

ON NEGATIVE ARTESIAN WELLS, OR ABSORBING BORED WELLS, AS A MEANS OF DRAINING LANDS, FARMS, BUILDINGS, &c.[*]

By Augustus Edward Bruckmann, Ph. Dr., Consulting Engineer and Geologist.

(*Continued from page* 626.)

Second Division.

Negative artesian wells in the Molasse and Jura formation, for the drainage of the ale cellars at Stetten, above Lonthal, belonging to the Count Maldeghem; with preliminary remarks.

The idea of reaching, by means of borings, strata through which marshy grounds or fens, or even ponds and lakes, may be laid dry, and by which superfluous or injurious water in general may be permanently got rid of, is not altogether a new one, as we have seen from the preceding disquisition; but the establishment of absorbing bore-holes has not been by any means so often realised as that of true artesian wells, although many formations and localities are better qualified for the execution of the former than of the latter. How many useless borings for rising spring-water have been already undertaken in highly-elevated countries and disruptured rocks, where, instead of getting rising springs, not unfrequently absorbent veins have been disclosed, which received and carried off the waters found in the superincumbent beds. Such attempts have proceeded either from ignorance or want of principle in those who undertook them, and who, only grasping at money, were careless of the results of their performances, their credit, and reputation. Out of several warning facts well known to me, I have made particular mention of only a single one in the first division of this paper. It is deeply to be regretted that such vast sums should have been wasted in such preposterous attempts.

About twenty-five years ago, when I had introduced artesian wells into Bavaria, among other engagements I was invited by the authorities of Pothenstein to travel to Gössweinstein, where they desired to establish a boring for rising spring-water. After I had examined the local conditions and formations of the place, I at once advised the relinquishing of the project, pointing out the impossibility of success; for Gössweinstein is about as highly elevated as the romantic rock of Lichtenstein, in Wirtemberg (now belonging to the Count William of Wirtemberg). The prevailing formation is the same—fissured coral rag; and at the foot of the rock, in the adjacent valley below Gössweinstein, three very abundant fresh-water springs break forth, similar to the sources of the Echatz, above Honau, near Lichtenstein; of the Blautopf, near Blaubeuren; of the Brenz, near Königsbronn; of the Kosher, near Aalen, &c., in Wirtemberg. I have also met with analogous phenomena in the elevated town of Rottenburg, on the Tauber, in Bavaria, situated on the upper shelly limestone, and in several other places; and, as a matter of course, I there also pointed out the impossibility of establishing artesian wells.

Under such circumstances, it would have been absurd and unprincipled to express even the least hope that borings for rising spring-water would be successful; the deeply-situated and copious outbreaks of springs existing there are the result of the atmospheric waters condensing, precipitating, and infiltrating on the plateaus in the environs and sinking down in the clefts of the stones, till they meet an obstacle—a basis impervious to water—which prevents their sinking down further, and forces them to break out in the form of springs. Thus, the mountains themselves are tapped by nature.

It does not properly come within the province of the present paper to explain how drinking-water can be procured in formations and situations in which artesian wells never can be executed with success,—such as by the establishment of bored, pump, or draw-wells, on elevated plains, highlands, or mountains; or, according to circumstances, by erecting "spring tanks,"[*] sinking shafts, tunneling, &c. On this point I may refer to my former publications[†] and practical works.

I would refer, for example, to the fissured upper coral rag, in which, under certain conditions, rising springs can never be met with; yet this rock, besides being useful for building and other purposes, is valuable for the permanent removal of the superfluous water, which not unfrequently accumulates in the more recent superposed clayey and marly ground.

According to my own experience, the jurassic or oolitic formation in general, even in its middle deposits, is more fitted for establishing absorbing borings than true artesian wells. Thus, for instance, about seventeen years ago, at Müllheim, in the Brisgau, I bored in it to a depth of 482 feet, without meeting with rising spring-water at this depth. The perforation was made in Oxford clay, lying upon Bradford clay,[‡] and a description of that boring may be found in the appendix to my German edition of Viollet's "Théorie des Puits Artésiens," already quoted, pp. 217-220 and pp. 223-229, where I have also described the serious difficulties and accidents which occurred during the course of this perforation, and the means by which I overcame them. Nevertheless, this boring, not yet finished, and only stopped for the present, bids fair, judging by the situation of Müllheim, to furnish rising spring-water, if the perforation be continued to the subjacent great oolite. In addition, I must remark that, in the lower division of the jurassic deposits, principally in the *Lias* (black jura), some artesian wells have successfully been established in Germany.

I shall now describe two successful negative artesian wells which I have lately executed.

His Excellency the Count of Maldeghem, lord of the manor of Niederstotzingen, &c., desired, towards the close of the year 1852, to have a positive artesian well established in the grounds of his castle at Niederstotzingen, after a former boring for spring-water, undertaken there by another engineer, had entirely failed. Above all, he wished to have the advice of an accredited and experienced engineer, and addressed himself upon this subject to the Royal Counsellor of Mines, Herr von Schübler,[*] in Stuttgart. This gentleman was kind enough to recommend and propose me for the purpose in question, and I was invited by the Count to travel from Darmstadt, in Hessia, where I then lived, to Niederstotzingen, to undertake the necessary geological and hydrographical preliminary researches. Unfortunately I could give no hope of success, for the somewhat elevated grounds of the castle, although covered with some miocene freshwater and molasse-marls of trifling thickness, had the fissured and absorbent coral rag[†] for a basis. I therefore at once dissuaded the Count from attempting the execution of an artesian well. But, in order to procure the desired spring in another way, the chief object of which was to feed a pond, I pointed out on the hill of molasse[‡] rising at the back and towards the north, where, besides, some spring-tanks (Brunnenstaben) had been already established, two spots on which some other such tanks might successfully be formed, and from which the water might be led to the neighbouring grounds of the castle by means of pipes. I had already tried the same plan under less favourable circumstances, in the year 1836, at Zwintemberg, a private estate of his Majesty King William I. of Wirtemberg, where I nevertheless succeeded in establishing a spring tank in the alpine diluvium,[§] out of which, ever since, an abundant supply of good drinking-water, through a series of water-pipes, flows to the neighbouring farm, which formerly had nothing but a common pump-well, with such bad water that even the cattle refused to drink it. In precisely the same way, and in the very same deposit (alpine diluvium), in the year 1846, I was fortunate enough to establish for the Count of Langenstein, at the castle of Langenstein, near Stokach, in the Grand Duchy of Baden, a tank which now supplies that castle, situated on an almost entirely isolated rock of coral rag, with good drinking-water in even a greater quantity than is required. There also I refused to bore for rising spring-water, for reasons which I have already given.

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[*] German: "Brunnenstaben."

[†] See for example, pp. 284-290 in my appendix to the German edition of Viollet's "Théorie des Puits Artésiens"—"Meber Arlegung gebohrter Schöpfbrunnen auf Hochebenen und Bergen."

[‡] Compare "Die Jura-Formationen des Breisganes geognostisch beschrieben von Carl Fromberg, Dr. der Medicin, ordentl. öffentlichem Professor der Chemie und Mineralogie zu der Universität zu Freiburg, Mitglied, &c. Mit zwei geognostischen Karten. Karlsruhe, 1838. Verlag von Christian Theodor Groos."

After the Count of Maldeghem saw, by the report which I gave him, that there was no hope of obtaining an artesian well in the grounds of his castle, he took me to the village of Stetten, above Lonthal, where he, among other properties, possesses a large brewery, the excellent ale of which is well known to the whole kingdom of Wirtemberg under the name of "Stotzinger beer."

When I arrived at Stetten, the Count drew my attention to the vexatious circumstance that water was always finding its way into both his strong-ale-cellars, which they were obliged partly to pump out and partly to draw out, in casks, at short intervals, at great expense, and with great loss of time, with considerable damage in other ways—damages to which all wet beer-cellars are liable.

It is essentially important to draw attention to the circumstance, proved by experience, that in a wet cellar mould forms on the casks, whereby the soundness of the wood is injured, and in a short time the wooden hoops get rotten, break, and fall off. Besides, if water gets into cellars, the temperature in them is raised,[*] and this operates injuriously upon the ale in two ways; for,

1. The evaporation of the water injures the quality of the beer, so that it is spoiled, loses its keeping property, turns flat, or becomes thick.

2. In summer time, no higher temperature should prevail in a strong-beer cellar (at least in the opinion of German brewers) than 5° to 6° Reaumur; whilst, in a winter-beer cellar, it may be allowed to increase to 8° or 10°, without injuring the beer. Nay, in winter time, we often see the air-holes of strong-beer cellars opened, in order to bring their temperature, if possible, to the freezing point, or, as German brewers say, *in order to have the cellars thoroughly frozen.*[†]

The dry rot of casks injuring the wood of the staves, and by degrees even destroying it, forms rapidly in every cellar which is too warm, even if it be dry, and the staves are made of the best wood. By establishing a current of air, however, together with a proper temperature, it can for the most part be prevented. During my practice, I once met with so interesting a case, that a short description of it may be allowed here.

Near the village of Staad, not far from the town of Constance, on the borders of the lake Constance, there is a large strong-beer-cellar cut out in a loose but dry rock of molasse, which, on its first establishment, was one of the best cellars to be found in the environs. But, not long afterwards, the proprietor, a Mr. Schalk, who, some years ago, successfully established himself as a brewer in North America, made the disagreeable discovery that the dry rot began to appear on the casks deposited there. I at that time (between 1840 and 1847) lived at Constance, and was municipal architect and teacher at the Technological Institution of that place, and likewise architect of the Count of Langenstein. Mr. Schalk invited me to examine into the matter, and, if possible, to remove the evil. I went with the proprietor to the spot. On the north side of the entrance to the cellar, at the bottom, on the right and left, there were two air-holes constructed, which could be opened and shut at pleasure. In the middle of the cellar-arch, cut out in the solid molasse, there was a wide perpendicular air-shaft, which, as I had been told, reached above the surface of the superincumbent soil, that is, above the open arable land. As soon as I entered the cellar, I was struck by the close atmosphere which prevailed in it. Both the air-holes of the north side were opened; we had torches and candles with us, but not the least movement of their flames was to be perceived—no draught in the whole large space of the cellar.

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[*] This gentleman was one of my examiners, in the year 1835.

[†] Overlying this rock, I found in the environs, here and there, marly Portland stone, which Auerstedt identifies with the lithographic limestone of Solenhofen and Pappenheim, in Bavaria, and calls it "Krebbsscheerenkalk" (limestone with crab's claws). See his "Flötzgebirge Württembergs."

[‡] This locality is well known to German geologists for its abundance of fossils. Bivalves do not often occur, it is true. with both their shells; and of the genera "Cardium" and "Cytherea" I found only casts; but beautiful specimens of Ostrea longirostris, Lmrk. (very common); O. cyathula, Lmrk.; O. flabellula, Lmrk; O. mutabilis, Desh; Pecten crassicostatus, Dunker; P. Hermanseni, Dkr., are to be met with.

[§] Compare page 10 of my work, "Der wassereiche artesische Brunnen im alpinischen Diluvium des oberschwäbischen Hochlandes zu Isny, in geognostisch-hydrographischer und constructiver Hinsicht. Nebsteinem Beitrage zur Kenntniss der Diluvialgerölle der Bodenseegegend. Mit einer lith. Gebirgsdurchnitts-zeichnung. Stuttgart. E. Schweizerbart'sche Veragshandlung und Druckerei. 1851." A review of this book is to be found in the "Heidelberger Zahrbücher der Literatur, Num. 20, 1851, pp. 312-313."

[*] It is well known in Germany and France that my father invented and introduced the application of the waters of artesian wells for the purpose of warming workmen's rooms in manufactories, and of melting the ice entirely from water-wheels, and communicated his discovery to the "Société d'Encouragement pour l'Industrie Nationale à Paris." See "Rapport fait par M. Héricart de Thury, au nom du comité des arts mécaniques, sur l'application des eaux des puits forés dans les usines et dans les ateliers, par M. de Bruckmann, architecte du Roi de Württemberg," in the bulletin of this Society of the year 1831, for August, p. 380, &c. Or compare pp. 26-63 of the first quoted work, "Vollständige Anleitung zur Anlage, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen." It will be found in those pages that, by means of the waters of artesian wells, hot-houses may also be warmed and winter gardens established, and that, conversely, the water in ponds and lakes, when it is too warm in summer time, may be cooled by the waters of artesian wells led into them, to prevent the fish from dying. Besides, see pp. 36-37, in "Le Puits Artésien de Grenelle, par M. Rey. Quatrième édition. Paris (Quai Malaquais, 15), 1845." The "Société d'Encouragement pour l'Industrie Nationale à Paris" bestowed upon my father, at the general meeting of the 29th of June, 1832, a gold medal for this invention and the communication of it to them.

[†] German: "Um die Keller ausfrieren zu lassen."

I immediately presumed from this observation that the upper air-shaft was entirely stopped. The owner protested against my opinion, and even maintained that its stoppage was an impossibility, observing that the mouth of this air-shaft, on the open arable field, was always kept open, and secured in a proper manner. In spite of these remarks, I insisted upon its being examined carefully. Ladders were brought, I ascended, and what did I discover? The air-shaft, in its upper part, was entirely laid over with deal boards, and a layer of mould thrown upon them, over which even the plough of the farmer had passed; in short, it had been closed hermetically.

What had hitherto been a riddle was now solved to the perfect satisfaction of the proprietor. Measures were taken for keeping open this air-shaft in future; the dry-rot disappeared, and since that time the cellar in question has again become one of the best establishments of its kind.

After this short digression, let us return to Stetten, above Lonthal.

The Count of Maldeghem, well knowing the advantages of dry cellars and the disadvantages of wet ones, inquired of me whether the injurious water which entered into both his ale-cellars could be effectually removed? I answered this question in the affirmative, proposing the establishment of absorbing bored wells. After I had explained the system, and its very probable success, I was requested to put my idea into execution.

Before I describe these successful borings themselves, I will give a geological and hydrographical description of Stetten, according to my own researches.

Stetten, above Lonthal, a catholic village of about 350 inhabitants, situated in the rather elevated bailiwick of Ulm, in the kingdom of Wirtemberg, lies upon the southern gentle descent of the jurassic rugged Suabian Alps, and at a short distance the valley of the Danube, chiefly forming a boggy country, extends towards the kingdom of Bavaria. Near Stetten there is the low-lying and rather narrow Lonthal (valley of the Lone), through which a rivulet winds, called "Lone," or "Lontel," traversing the bailiwick from west to east. The village lies partly on the western slope of the so-called "Gemeinde" (an ascent of a hill, in terraces), partly in a narrow little valley, from which rises, in a western direction, the higher "Stumphau." Further back, however, is the high alpine village of "Bissingen." Towards the east, the ascent of the "Gemeinde"—a hill, on the top of which both the Count's strong-beer cellars are built—leads into a plateau of fir wood, the surface of which, gradually rising about 25 feet, unites with the "Sandfield," the before-mentioned molasse of Niederstotzingen. The latter locality lies 1,855 Wirtemberg feet above the level of the sea, and about 200 feet above the neighbouring Danube, so that the elevation of the strong-beer-cellars in question may be approxim ately given as 1,830 feet above the level of the sea.

Towards the south, the small valley of the village runs along, first rising, then falling between the villages of Asselfingen and Oberstotzingen, and uniting with the plain of the Danube. Towards the north, the narrow valley in the so-called "Wiese" (meadow), under the castle, and the "Niederfeld" (low field), gradually descends to the Lonthal.

From the northern end of Stetten, in an eastern direction, a narrow little valley, "Reitschule und Brunnenwiese," runs nearly a mile upwards to the Sparrenwald (a wood), and passes by degrees into the plateau of the Sandfield, where, as I have already shown, the marine molasse of Niederstotzingen, with its large ostracites, &c., is deposited. Ascending this little valley from the village, we find it bounded on the right hand (southerly) by the fir wood before spoken of, and on the left by the "Stehberg," "Büschelesberg," &c., which all pass into the "Sandfield" further up.

At the bottom of the Stebberg, and for a short distance also at the bottom of the fir-wood, hard fissured coral rag crops out; the same rock is to be seen at the western and northern foot of the "Gemeinde" (already mentioned), and on its northern descent we find it partly covered with Portland stone, alternating with compact marls. The middle division of this hill upon which I undertook the absorbent borings, consists of the upper fresh-water bed, and the uppermost one of marls belonging to the molasse, which latter, in a thin bed, extends from the "Sandfield" to this place. As for the rest, the hills and mountains of the environs chiefly consist of coral rag, which, covered with Portland stone, is exposed in the large quarry of the neighbouring village of Oberstotzingen, becoming sometimes oolitic, as at Schnaitheim, in Wirtemberg, and, besides its known characteristic fossils, enclosing nodules of horn-stone and crystals of quartz and chalcedony. I found there—*Astraea alevolata* and *heliantoides*, Goldfuss; *Terebratula biplicata*, Sou; *T. difformis*, Lmrk.; *Pecten*, and *Nerinea* species.

The prevailing character of the coral rag of all the environs, (which is of a whitish, grayish, and yellowish colour, but not often reddish,* and contains not unfrequently veins of calc spar), is—extreme hardness, with extensive irregular disruptions, concavities and land-slips. In the deeper lying part of the village of Stetten itself, there are found, in the tile-kiln and near it, so-called land-slips, but which, according to my own observation, are nothing but, large clefts in the coral rag. Rain-water flowing into them, as well as any water purposely poured in, runs down rapidly and disappears, combining with the system of springs in the deeper lying Lonthal. Among the larger caverns in the limestone, the "Hohle Stein" (hollow stone) and the "Stadel," on the common land of Asselfingen, two miles from Stetten, are distinguished; but also nearer the latter village, in a north-western direction, at the "Vogelherde (fowling floor), on the road to the alpine village of Bissingen, there is a somewhat extensive, but low cavern, with stalactites.

At the northern end of Stetten the Count's castle, the church, and the brewery are romantically situated, upon a rock of coral rag, rapidly descending to the adjacent valley of the "Wiese."

The descent of the "Gemeinde," the elevation of which above the level of the sea I have given as 1830 feet, amounts to 70 feet measured from the strong-beer-cellars in a western direction, with a horizontal length of 700 feet to the school house in Stetten; but from that spot a further descent of the ground in the village takes place towards the tile-kiln, &c., in general to the little valley of Stetten.

The coral rag surrounds the western and northern base of the hill of the "Gemeinde" like a belt; it gently and irregularly falls away from south-west to north-east, and the molasse, together with its subordinate fresh-water beds, seems to have been stopped by it. In the perforation in front of the new ale-cellar, the coral rag was only reached at a depth of 76 feet 1 inch and 8 lines, while it rises much higher at the bottom of the "Gemeinde."

The plateaus and slopes of the mountains in the nearest environs are covered with extensive oak forests, rarely with beech and fir. These forests, undoubtedly, cause the condensation and infiltration of a great quantity of aqueous vapours, and I attribute to this circumstance the existence of the springs pervading the upper and more recent strata of the ground near Stetten, as will shortly be shown. The percolation of the injurious waters into both the beer-cellars in question is occasioned by that phenomenon. What important influence forests exert upon the formation of springs, and what detrimental effect is created by rooting out and destroying forests, I have shown in my works already published, enumerating several striking facts with reference to the continent of Europe* as well as America, and I must refer to them for brevity's sake; but, in making such observations, we must be on our guard against taking *inorganic* springs for *organic ones*,† since the latter are entirely independent of the vegetable relations of a country.

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* At the mountain of the old mountain-castle of "Kaltenburg," joining the Lonthal, there are yellowish and reddish masses to be found, spotted like marble, and called "Wild Marble." The Belvidere in the garden of the castle at Niederstotzingen is chiefly built of this material.

Stetten has a privilege not enjoyed by many villages of the Swabian Alps, that is, a clear, wholesome, and abundantly-flowing drinking water. There are five chief springs there, enclosed in tanks, which conduct the required water supply to the village and the Count's brewery by a series of water pipes, and four of them lie not far from the new strong-beer-cellar, on the northern border of the fir-wood at that place, and only a little below the general ground level of the "Gemeinde." All these springs arise from the strata of molasse, between sandstone and marl, and sometimes carry sand with them, which they deposit. Somewhat further up there is a pond, for the purpose of steeping wooden conduit pipes; it is fed by little springs, entering on the north side, and likewise rising out of strata of molasse. This pond serves, besides the purpose of preserving the wooden conduit pipes, as a reservoir in case of fire. Ten minutes' walk in a north-eastern direction from the new cellar, the fifth chief spring, "Schlossfeldquelle" by name, in the "Buschelesteich," arises from the same formation, and, enclosed in a tank, is connected with the others by water pipes, and has about the same level as this cellar.

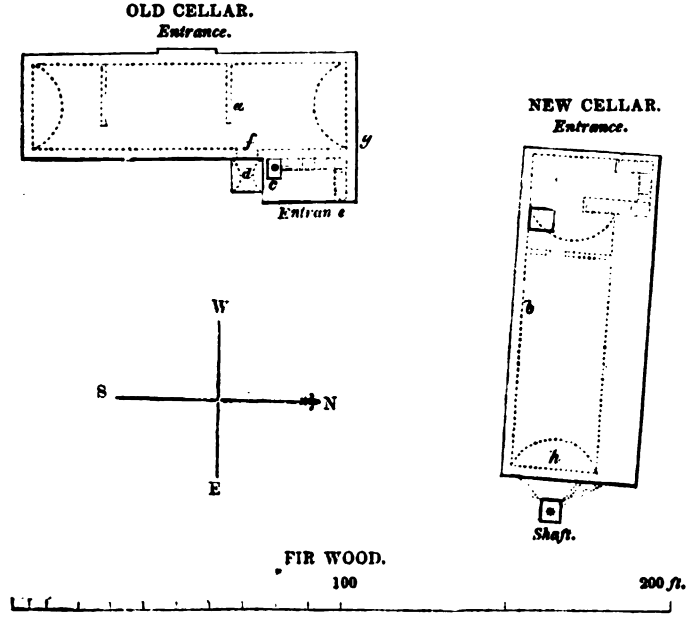
The superfluous water of the oveflowing wells of Stetten and of the pond, winds through a little valley, called "Niederfeld," to the Lonthal. Besides these springs, no other flowing water is to be found near the village, except the Lone in the Lonthal.

The springs in question form a peculiar system, all coming forth from the boundary line of the marine molasse and its fresh-water deposit, and having no connexion at all with the subjacent jurassic rocks. Although it was apprehended, as I was told, that by my borings the aforesaid springs might be impaired in their quantity, or, perhaps, dried up, yet I was able at once to contradict this notion, and experience has shown that I was right. It would lead me too far to speak more on this subject, and to explain it further by geological and hydrographical sections, but I cannot withhold the general remark, that in projects to obtain drinking water under certain geological conditions, it is often very advisable to operate only in the upper ground, instead of going down to a greater depth.

We will now proceed to the description of the absorbing bored wells.

Plate I. is a plan of the situation of both the count's strong-beer-cellars, of which the old one was built in the year 1832, the new one in the year 1834. They lie near the upper edge of the "Gemeinde," already several times mentioned, where the plateau of the fir-wood begins, and in an elevation of 1830 feet above the level of the sea, as we already know, 70 feet above the ground of the schoolhouse in Stetten, and in a horizontal direction 700 feet distant from it. The troublesome and continued penetration of the water into the cellars took place from the east side of the fir-wood, whilst from the west no percolation could be perceived at all, and scarcely any traces of infiltration were to be discovered on the south and north sides of the cellars. Under these circumstances I considered it most advisable to cut off and turn aside the water on the outside of the new beer cellar, by a shaft to be sunk in an eastern direction, before I began carrying down a perforation in which the waters were to fall and sink, and so much the more, as a boring in this cellar itself could never have prevented its eastern and high retaining wall* from being wetted injuriously. On the 27th September, 1852, I arrived at Stetten, after my boring apparatus had already been taken there, and immediately gave the necessary instructions for the preliminary measures. Although the boring in the old strong-beer-cellar was performed during the sinking of the shaft in front of the new cellar, I shall first describe the latter work, being the most important:—

GROUND PLAN OF THE CELLARS.—Plate I.



At a distance of 6 feet from its eastern retaining wall, which is 27 feet 3 inches high (see Plan I), a shaft, six feet square, was sunk to a depth of 33 feet, in a thoroughly solid manner, in order not to injure the high retaining wall close by; thus the bottom of the shaft was laid almost 6 feet deeper than that of the cellar. A description of the geological strata cut through will be given further on, and here I meanwhile remark, that at a depth of 19 feet, the first percolating water was discovered entering

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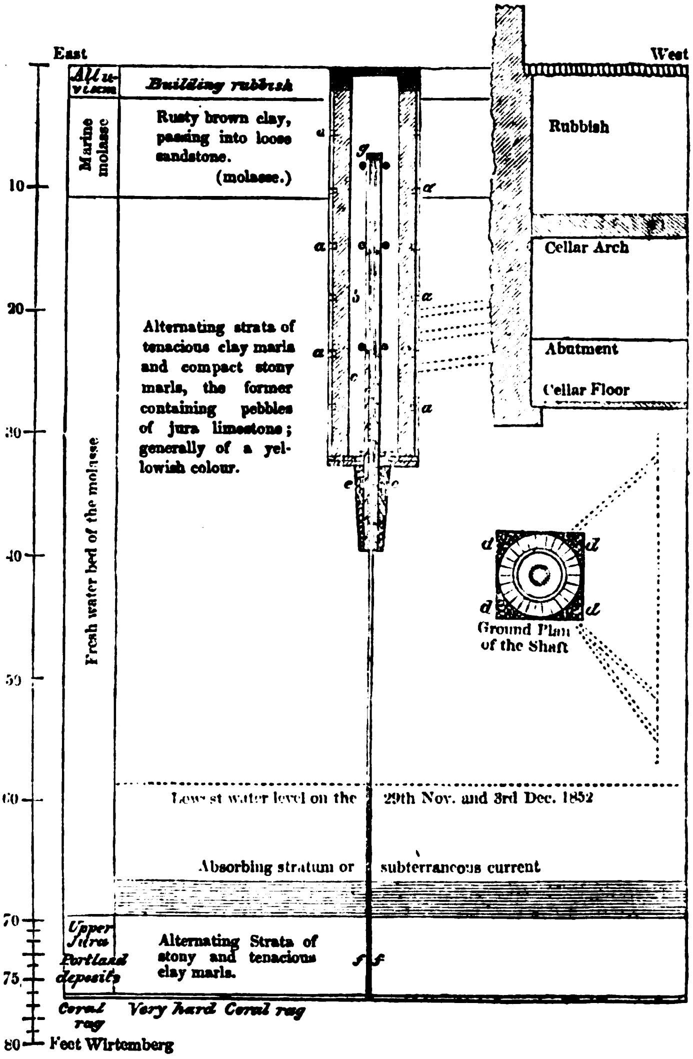
* See, for example, pp. 36-48 in my work:—"Der wasserreiche artesische Brunnen im alpinischen Diluvium des oberschwäbischen Hochlandes zu Isny," &c. Stuttgart, 1851.

† My original opinion of inorganic and organic springs is to be found in my appendix to the German edition of "Viollet's Théorie des Puits Artésiens." Compare, besides, the singular work:—"Die Räthsel unserer Auellen oder Kritik aller wichtigeren bisher aufgestellten Theorien über den Ursprung, die Perisdicität, die chemische Beschaffenheit der Auellen unserer Erde, &c., &c., von Dr. A. F. P. Nowák. Leipzig (O. Wigand), 1844."

* German: Schildmauer.

SECTION OF THE WELL AT THE NEW CELLAR.—Plate II.


East
West
Allu-vium
Building rubbish
Marine molasse
Rusty brown clay, passing into loose sandstone. (molasse.)
Rubbish
Cellar Arch
Abutment
Cellar Floor
Alternating strata of tenacious clay marls and compact stony marls, the former containing pebbles of jura limestone; generally of a yellowish colour.
Fresh water bed of the molasse
Ground Plan of the Shaft
d
d
d
d
a
a
a
a
a
a
a
b
c
e
f
f
g
Lowest water level on the 29th Nov. and 3rd Dec. 1852
Absorbing stratum or subterraneous current
Upper Jura
Portland deposits
Alternating Strata of stony and tenacious clay marls.
Coral rag
Very hard Coral rag
10
20
30
40
50
60
70
75
80
Feet Wirtemberg

from the east-side, and increasing as the shaft was sunk deeper; but this water came in only at a depth of between 19 and 25 feet, out of a bed of fresh-water marl, while the ground above and below was dry. After the shaft was carried down to a depth of full 20 feet, at night generally from 45 to 78 cubic feet of water accumulated in it, which had always to be brought up before the sinking of the shaft could be continued. Some time afterwards the quantity of this water diminished to 13 cubic feet 101 cubic inches, and in the night of the 29th of October, after the shaft was already finished at a depth of 33 feet, and a reservoir (pit) made at the bottom of it, only 9 cubic feet of water had entered it, a measure which afterwards remained tolerably constant, and was only sometimes increased by the continuous and heavy rains in that country which frequently occurred in the late season of the year 1852.

The striking diminution of the water at first gave room for the conjecture that the freshwater marls, disclosed at the lower part of the shaft, might already have the capacity of absorbing a part of the water. This opinion, however, was not confirmed; the clay marls in question were compact, and not in the least sandy or porous, and I explain the reason of this phenomenon in the following manner:—

By the sinking of the shaft, the main supply of the percolating water coming from the east was at once cut off; the ground of the fir wood at the back was saturated from the depth of 19 feet to that of 25 feet with water, which found an almost closed dam in the retaining wall of the cellar. At first this water, so dammed up, could pour into the shaft in its maximum quantity, because this watery stratum, six feet thick, was suddenly and vertically laid open by the sinking of the shaft, but by degrees this percolation of the water necessarily diminished, by the continual emptying or draining of the stratum in question, until a normal state of permanence was gradually established.

Even during the sinking of the shaft, and especially when it was carried down below the bottom of the cellar, a diminution of the water in the latter could be perceived, whilst up to that time it had hitherto always come in through the joints of the retaining wall at different spots, running into the pit placed at *b* (see Plate I.), from whence it had to be pumped out very often. Several spots of this retaining wall which were formerly wet began now to dry up, instead of the water entering as hitherto, and partly washing away the mortar and injuring the masonry.

The boring then began at the bottom of the reservoir formed at the bottom of the shaft, and in clay marls of the fresh-water formation, inclosing many pebbles of jura limestone. This ground was very much inclined to crumble and fall in, and, therefore, I intended to sink wooden tubes, but as it was impossible to get an iron shoe[*] made in that country, which was absolutely necessary for this purpose, I was obliged to make a virtue of necessity, and, contrary to the technical rules, to set the tubes upon the grounds without a shoe, and without being able to sink them down. I began the boring at a venture, resolved, however, after its termination, to protect the hole against the falling ground by means of metal tubes.

I will not fatigue the reader by technical details; in short, the hole had a diameter of four inches (Wirtemberg); the perforation was carried on as rapidly as possible, and the ground which fell in during the boring was always quickly removed. The water in the shaft, which in the course of the perforation was no longer brought up, accumulated in a large quantity, and rose, as was to be expected, so high, that it even penetrated through the retaining wall again, and flowed on to the bottom of the cellar.

When, on the 26th of November, a depth of 66 feet 7 inches and 3 lines (taken from the upper soil or the way board of the shaft) was attained, the borer, which I happened to be directing with my own hand, sank rapidly down through a stratum three feet deep, filled with sand

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[*] See Fig. 7 on Table IV. in the work by my father and myself: "Vollständige Anleitung, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen"

and pebbles of jura limestone, and at the very same moment the column of water in the shaft began to sink, and by degrees, more and more slowly, it disappeared, so that it had completely run out of the shaft during the night of the 26th of November. The water from the shaft could easily enter the bored hole, for the lower division of the wooden tubes had purposely been pierced before being inserted into it, as may be seen in the section on Plate II.

Now, I had found the desired and expected absorbent stratum; or, more properly speaking, I had met with a subterraneous current of water, which would perpetually absorb the water draining into the shaft.

It is essential to remark that this absorbent stratum, the vertical section of which amounts to three feet, is situated in the boundary between the fresh-water bed and the upper jura formation; and this interesting fact confirms anew what I have experienced and maintained on several occasions, viz., that "*positive as well as negative strata, that is, such as supply and such as carry off water, are principally found between the alternating plains of heterogeneous deposits.*"

If I had not been thus early successful, I should have continued the boring with the fullest confidence of finding in the coral rag itself powerfully absorbent cavities, which, if it was necessary, would have been able to receive and carry off a whole brook or rivulet;[*] for what experienced geologist, looking at the geological and hydrographical conditions of Stetten, as above described by me, could have doubted the success of this perforation?

As the subterraneous current of water brought a great quantity of sand and pebbles of jura limestone into the bored hole, I found it advisable to cut through the subjacent Portland bed, and to penetrate a little way into the hard coral-rag, in order by this means to free the absorbent stratum from the pebbles, and thus prevent the future stoppage of it. To clear this stratum completely was of the utmost importance, in order to successful subsequent working. Of this I had an instance in the case of the positive artesian well in the Alpine diluvium which I established in the town of Isny, in the year 1841.[†]

As the water from the shaft and the bored hole flowed into the absorbent stratum with a decreasing velocity, and irregularly—a circumstance occasioned no doubt by the pressure of the pebbles—and besides, on account of the very rainy weather at that time the water entered in greater quantity, it is difficult, nay, impossible, to fix an accurate arithmetical mean of the quantity of the escaping water, though I undertook several very exact measurements. The following experiment gives a general view:—

In order to be convinced of the continuance of absorption of the stratum in question, I ordered, in the afternoon, at two o'clock, of the 30th of November, five Wirtemberg kilderkins, or 62 cubic feet 800 cubic inches of water to be brought and rapidly poured into the bored hole through a pipe, whereupon it found its level in the shaft at a depth of 32 feet 8 inches and 1 line under the way board, rising, therefore, very little above the bottom. After the first four minutes, 7 cubic feet 350 cubic inches of water had escaped; sixteen minutes afterwards, however, 4 cubic feet 900 cubic inches of water had disappeared. In two hours and a quarter 19 cubic feet and 110 cubic inches of the water poured in went off, but it must be observed that, in consequence of heavy showers of rain at that time, a considerable quantity of drainage water entered the shaft, which had to be carried off with the other, and it is therefore impossible to give a correct measurement of it. Soon afterwards the water had entirely left the bottom of the shaft.

This experiment was witnessed, in the absence of the Count of Maldeghem, by his intelligent and active steward, Mr. Keller, mayor of the town of Niederstotzingen, who, in the first instance, fully saw the advantage and probable success of my borings, and who, therefore, gave his strenuous support from the beginning to the end of the work, although several unprofessional men had repeatedly declared the affair a rash undertaking.

(*To be continued.*)

ON THE SECURITY AND MANUFACTURE OF BANK NOTES.

This subject has so frequently occupied the attention of this Society, that the following abstract of a lecture delivered by Mr. Henry Bradbury, at the Royal Institution, will be interesting to the readers of the *Journal*.

In calling attention to the many processes connected with the manufacture of bank-notes, Mr. Bradbury said, his object was rather to direct attention to the consideration of the most important feature in their manufacture, namely, the engraving, because upon it their security in the eyes of the public mainly depended. It was of importance to discuss this question; forgery was on the increase, and difference of opinion existed as to the soundest method for obviating it; facilities were growing up to assist forgery; and, further, there was a tendency to employ that method which in reality was most exposed to the operations of the forger, If we could be sure that the advance of genuine Art must ever distance that of the spurious—if the success of the forger were to stand in an inverse ratio to the genius of the artist—and if we were to ignore the wonderful skill and ability of the so-called uneducated classes—then indeed this subject would lose a considerabte portion of its interest, and its technicality would be deprived of its moral importance.

Had, however, the Report of the Committee of the Society of Arts[*] (though sitting upon this question so far back as 1819) been acted upon, it appeared that this state of things could never have arisen, for they arrived at those sound conclusions which were perfectly applicable at the present day. This Committee was organised in consequence of the rapid increase of convictions for the circulation of Bank of England note forgeries. Juries began at last to feel a reluctance to visit with capital punishment a crime, for the prevention of which no proper precautions seemed to have been taken. The fact also, that forged notes had passed undetected the scrutiny of the Bank inspectors, determined the Society of Arts to take this step. The point for their especial consideration was, to determine the means within the compass of Art, not so much totally to prevent the forgery of Bank of England notes (for that was obviously impossible), as to elicit means of detection by increasing difficulty of imitation.

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[*] The capacity of absorption of a bore may, under certain circumstances, be very considerable, especially if ramified fissures or cavities have been disclosed. Even common absorbent strata or subterraneous currents are sometimes capable of carrying off a large quantity of fluids, and out of some results obtained in France. the following is a proof of what I have just said. It was communicated by M. Arago, in the "Annuaire" for the year 1835. pp. 245-246, and I here give a translation of it:—"A manufacturer of potato starch at Villetaneuse, a little village a league from St. Denis, in the winter of 1832-3, by means of a well bored to the depth of certain earthy absorbent strata, daily got rid of 80,000 litres of foul water, the disagreeable odour of which gave rise to complaints which would probably have compelled him to remove his establishment. After five months' daily absorption the borer found nothing but sand at the bottom of this well, and it has ever since worked as well as at first."

[†] See p. 28 in my work already quoted:—"Der wasserreiche artesische Brunnen im alpinischen Diluvium des obserwäbischen Hochlandes su Isny, &c."

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[*] Report of the Committee of the Society of Arts, on the Mode of Preventing the Forgery of Bank Notes, &c. London, 1819.

That report was one of great value, and remained in these days still further capable of extension, with the aid of a nice judgment, joined to artistic advantages which could now be commanded, to obviate many of the difficulties which originally beset this subject.

The main feature, then, of the note, the engraving, and its security, had been proved in practice, as well as deposed to by artists of eminence, to depend upon the vignette. The higher the quality of the artistic impress, therefore, which the vignette carried—the purer and severer the tone conferred upon its execution—the greater the security of the note. This artistic impress might be still further extended to the whole face of the production.

The great value of the vignette consisted in this, that it was the uncounterfeitable seal of the note—uncounterfeitable, because, though it might be imitated, its individuality could not. Thus, a picture always conveyed the style of the artist, exhibiting a special individuality which no copy could possess.

Rival engravers might produce works of similar beauty and general effect, but the difference of manner would be obvious to the commonest observer, and not only would the forgery be discovered, but the hand that had executed it would be identified. The eye of the banking-clerk or the man of business would soon become expert at this kind of fine art reading. This was proved in the case of the Plymouth Bank half a century ago; their bills were forged—their notes were not, simply on account of the vignette. When the vignette was added to the bills, the forgeries ceased.

Mr. Bradbury spoke of the various methods of engraving, the choice more especially lying between that of *intaglio* and *surface-engraving*, between steel and copper-plate, or letter-press and wood-engraving. Of the two, the first ranked pre-eminent, both for its beauty and adaptibility to the production of bank-notes. The objections as to cost of reproduction and want of individuality no longer existed, the electrotype giving from one original an infinity of reproduction, with little more than nominal outlay.

With regard to letter-press or surface-engraving, Mr. Bradbury considered it incapable of realising a high standard of artistic finish; and that its cheapness, combined with rapidity of production, was not sufficient to counterbalance the absence of continuous and unalterable individuality. Contrary evidence had to be contended against, the notes of the Bank of England, those of the Bank of France, Bank of Belgium, and Bank of Russia, being printed from surface-engraved plates. Such evidence could not countervail the immeasurable superiority of *intaglio* engraving for the main object desired,—namely, security.

In the engraving of the bank note two principles were involved for consideration: first, the *simplicity* of its design, the purity of which was the guage of its perfection; secondly, the combination of vignette-work with intricate engine-work; both these principles possessed high claims to the attention of banking authorities as security against forgery—the one on account of the difficulty of mechanical imitation—the other on the principle of the certainty of a first-sight recognition. Simplicity of design, when it amounted to the character of high-class Art, was much the best with regard to the issue of National notes.

By way of illustrating this principle, Mr. Bradbury submitted an imaginary note of the Bank of England. This note he considered as simple as a national note could safely be. Its attributes were individual unity, if not beauty; simple and salient features, with due prominency of numerical value.

Breadth of design and unity of purpose were sought for. Care had been taken in the introduction of the ornamentation, that it should not assume a position so prominent as to weaken the artistic effect, but rather serve as an auxiliary to Art.

The Bank of England note had always been characterised by simplicity, but carried to an extreme, the same general design having been preserved from the issue of their first note. The objection was that its simplicity was *too* simple,—not bearing upon the face of it those features which characterised the true Art-point. The vignette was a specimen the reverse of that which had been advocated; it was alike deficient in conception and execution. Surface-printing having been chosen as the medium, the Bank authorities were restricted in the application of their Art. Their great aim had been to secure simple identity and ready recognition through the excellence of the paper, known by its peculiar colour, by its thinness and transparency, as well as by its feel, crisp and tough, patent to the sense of touch alone. The basis of its security to the public rested upon its paper. Successful imitations, however, had been made abroad, and passed in this country. The fallacy of its security consisted in the extreme facility it afforded for reproduction by hand, apart from reproduction afforded either by the Anastatic or Photographic processes. From 1837 to 1854, these notes were printed from steel plates, reproduced by the Siderographic or Transfer process; at the commencement of 1855, a change took place in the production of the notes by the substitution of surface-printing from electrotypes for steel-plate printing. A variation was then made in the form of the old note, by adopting an engraved signature instead of a manual one—the object being still further to strengthen the identity of recognition.

The note of the Bank of France for 100 francs was a fair specimen of surface-printing, but its inferiority of design indicated that it had been adapted to its limited capabilities. The note for 1,000 francs was less exposed to the objections raised against the note for 100 francs, the difficulties of copying by hand being very great. These notes were printed upon both sides at once, effected by pulling an impression on the tympan itself before pulling each impression of the note; the reason for so doing was, that when the impression was pulled upon the face of the note, the paper received two impressions at the same time—the one, on the face of the note from the printing plate—the other, on the reverse of the note, transferred from each impression on the tympan pulled previous to the genuine impression. The two impressions must necessarily register. This course had been pursued with the idea that perfect register of the two printings was a good gauge for detecting imitations. There was some reason in this, as it was a most difficult operation, requiring consummate skill. It was said that not more than three hundred impressions were printed daily at one press—this did not speak much for economical production.

Simplicity of design was not to be advocated as solely applicable to a note in all instances. It was more especially suited for national notes, because immediate recognition should be one of their essential features; but for provincial or local notes, not having so wide a commercial circulating range, the complex note had peculiar advantages; the display of national emblems—ideal impress and intuitive recognition being here unnecessary. One merit in particular which it possessed was, that it was more available to represent small amounts, and for circulation among the humbler classes, for an obvious reason, the repetition of the amount represented affording to the holder a more continued appreciation of its value.

Art was the principle of a simple note; mechanics, or engraving by machinery, that of a complex note. This was performed in two ways: relief and medallion-work, guilloche or rose-engine work. The one represented models on flat surfaces; the other, lines, straight, waved, or curved, circles, ellipses, parallel or intersecting, resulting in a particular effect. Different results were sought in the combinations produced from such machines; some preferred figures white on black, others the reverse. The latter was less confused than the former, its effect more beautiful, and it afforded a much greater probability of detection.

In the instruments used for the execution of these designs (being the laboriously-perfected construction of F. J. Wagner, K.H. Mechanicus, of Berlin), the adjustment admitted such variety that, even allowing the forger to be possessed of a similar instrument, the chances against hitting on the several requisites to produce any particular pattern were infinite. It was possible, he (Mr. Bradbury) thought, to combine, even within this intricacy of pattern and ornament, an idea of simplicity and singleness of recognition.

Mr. Bradbury exhibited a note produced by such means, in which he showed that Art might be made to hold an important place, for idea in design could be seen in its impress, and thus almost the same, if not greater, from its mechanical construction, amount of security might be guaranteed, previously stated to have been the object of *simplicity*. It possessed unity of parts and purposes in design which told much against the imitator. Such a note might be a small and convenient note, and could be divided into four parts, for postal security.

Too much ornamentation was apt to bewilder, nay, misguide—too little, liable to abuse; but a proper combination of a certain amount of elaborate mechanical work, properly balanced to meet the effect of the design, could also combine beauty with security, with hardly less facility of recognition.

The feasibility of this had been lost sight of; indeed, it was not practicable until the electrotype was known. By this power, surfaces of any given dimensions could be multiplied, without reference to the quantity or delicacy of the work; not so by the mode of reproduction known as the siderographic process, for transferring objects from steel to steel. It required retouching, an objection not at all applying to the electrotype.

Since the discovery of the electrotype, efforts had been made to apply its perpetuating power to the reproduction of copper engravings, but in every case with signal failure. The average number of impressions from one plate rarely exceeded 500; the electro-copper, too, spread, from the pressure of the printing-press, and, in addition, from its softness, even curled round the cylinders. Too little attention was paid to the science of electro-deposition. An experiment was made a few months ago, to re-establish in this country (for it has long been in successful operation at Vienna) its practical as well as its economical adaptibility. This experiment was made upon the note of the Bank of Brazil, amounting to 1,200,000 notes, of very elaborate work. At the completion of this work, the means for future production existed for printing as many million notes more as thousands have already been printed. The electro-plates in this instance, partly owing to the increased hardness in the copper deposited, and partly owing to a particular method of treatment, yielded, on an average, 1,600 perfect impressions, and experiments are in course of operation for increasing this to between 3,000 and 4,000. The peculiar advantage of the electro over the siderographic process will be apparent, seeing that the electro copies the whole surface—and furthermore, it copies the exact state of the plates, without requiring the aid of scraper or burnisher, or that careful retouching and deepening of lines so indispensable to the success of siderography.

This is a process for transferring figures from steel to steel, and thus multiplying the number of plates. It is one of exceeding simplicity, but, however simple it may appear, it requires more than ordinary skill to effect successfully that little of which it is capable. It consists in taking up an engraved plate upon a roller of softened steel, a combination of rolling and pressure. The engraved subject thus stands in relief upon the roller. Identical plates are thus said to be produced. The objections are threefold—first, every subject so transferred must be subsequently retouched by the graver; secondly, its transferring properties are limited to very small subjects; thirdly, and as a consequence, it is inapplicable to the manufacture of complex notes.

It has been in use for thirty years or more in America; in fact, it was the invention of an American; but the notes of the United States Government are not, and never have been—beautiful as their execution is—carried out after the principles advocated above. Referring to the American notes, it is a curious fact that, America being divided into so many States, and each State being represented by a different note, forgers did not think it worth their while to imitate, and therefore concocted notes of their own.

In the bank-notes of other countries there is an entire absence of all those qualities which have been insisted upon, and actually, in many instances, they appear to offer a premium to forgery.

The notes of the United States present specimens of the highest order, but the subjects selected seem irrespective of their purpose, and the multiplicity of the figures distracts the attention. The Austrian notes fall considerably below the standard of American excellence. Prussian notes, too, partake of the same objections—preserving, in many instances, the appearance of fancy stationery. The Russian notes might well be adopted for merchandise labels.

Great reliance for security was placed upon a combination of processes, and the greater the number employed in their construction—the more different the effect resulting from each—the more difficult it was supposed for the power of a single forger to embrace the exercise of the whole. This was a fallacious dependence, for the confusion created tended to less particularity of observance upon the part of the public.

The question of security was one of most difficult solution. It was said that what has been executed by one individual may be copied by another; and it was not in the nature of things that a person who cannot read, should be protected from imposition by the most clumsy forgery. Science affords facilities for the reproduction of almost everything; while she helps the producer, she does not withhold her help from the imitator. The first reason Mr. Bradbury could not admit as valid, and the general spread of education disposed of the second.

Mr. Bradbury, while he admitted the great value and capabilities of the anastatic process as a means of copying, yet thought it was incapable of reproducing very fine copperplate work. Here, then, was security against its use in reference to notes. Again, with reference to photography. Up to the present time it had not been made available for the production of a perfect copy, but great advances have been made. A process had lately been discovered capable of producing a more serious result than that previously obtained; namely, a printing-plate.

Printing in different colours, superposed, presented almost insuperable difficulties in the way of copying by the anastatic or photographic processes. These processes, however, must not be disregarded.

If no notice be taken of them by bankers, if forgers perceive that increased facilities for copying are not met by increased efforts to defeat them, such indifference only gave encouragement for cultivating forgery as a science.

The water-mark was not regarded as unimportant, though secondary to the main consideration; for a successful copy of a good engraving upon a spurious water-mark was more likely to impose upon the ignorant than an inferior engraving upon the genuine water-mark. If then the water-mark were backed by the excellence of art and engraving, it might safely be asserted that the bank note was unforgeable. But it may be said, if the paper thus alone furnished an absolute security, why make so great a parade of art, design, engraving, &c., in its manufacture? Because, whatever internal security existed in the paper, tended rather to the security of the bank. There should also be a *primâ facie* security for the public; and if both are applied, they re-acted upon each other, and the note was perfect.

Mr. Bradbury concluded by saying, "Let art be impressed upon the note. Let ingenuity of design, executed by a hand whose genius would at once indicate its authority, be adopted so far as is consistent with a commercial purpose. Let that mode of printing be employed which alone can render the delicacy and force of an art-subject. If this course be followed, the greatest possible amount of difficulty would be placed in the way of reproduction by hand; the two scientific processes referred to cannot be brought to bear against it—and further, which should be another grand object, this art-education of the people would eventually teach them prudence in distinguishing the genuine from the false."

PUBLIC HEALTH.

The following is extracted from the Registrar-General's last Quarterly Report:—

"At this season of the year, when many people are travelling on the continent, as well as in England, it may be useful to state that it is now well established, by extensive observation, that England is the healthiest country in Europe. France stands next to England in salubrity. In the continental cities the annual rate of mortality is seldom less than 30 in 1,000; and the rate frequently rises to 40 in 1,000. In London the rate of mortality is 25 in 1,000.

"On an average of ten years (1841—50) the mortality was at the annual rate per 1,000 of 15 in three English districts, 16 in 14 districts, 17 in 47 districts, 18 in 87 districts. These facts prove that the climate of England is eminently salubrious; and it has not yet been shown that the climate of any part of the continent is equally or more salubrious than this island, crowned with hills of moderate elevation, sloping towards the east and the south; bathed by the showers of the Atlantic, drained naturally by rivers running short courses to the sea, cultivated more extensively than other lands, and producing those unequalled breeds of sheep, cattle, and horses, which flourish only in healthy places.

"The healthiest parts of England are not yet places of general resort, but the annual mortality in the various districts comprising watering-places seldom exceeds 21 in 1,000 of the population, and is probably lower in those regions of the districts to which visitors resort. Hastings, Brighton, the Isle of Wight, Worthing, Mutford (including Lowestoft), Newton Abbot, Barnstaple (including Ilfracombe), Bath, and Cheltenham have experienced low rates of mortality during the spring quarter; and it should be always borne in mind in selecting places of resort that, through the peculiar nature of zymotic diseases, places usually healthy are periodically visited by epidemics, which can only be avoided by consulting recent returns, or by actual inquiries on the spot. The cleansing and the sewerage of all watering-places require improvement, as their arrangements were made when sanitary science was at a low ebb."

ROYAL SCOTTISH SOCIETY OF ARTS.

At at a meeting held on Monday, 14th July, 1856, Professor George Wilson, M.D., F.R.S.E., President, in the chair, the following communications were made:—

1. On the Manufacture of Ropes and Paper from the Stem of the Hollyhock. By Mr. James Niven, gardener to Wm. Stirling, Esq., of Kier. Communicated by the President. Specimens, in illustration, were exhibited.—This invention relates to the application or employment and use of the common garden hollyhock, or the *Althea rosea* of Linnœus, and other plants in the natural family *Malvaceæ*, in the manufacture or production of the pulpy material or fibre from which paper is to be made, as well as in the manufacture or production of fibrous material for textile purposes. In the adaptation of these plants, or their varieties, they may be used either in a green or dried state; they are prepared by being broken up by any of the ordinary means as hitherto used for the disintegration of vegetable fibres—the whole plant being suited, after disintegration, for the production of pulp for the manufacture of paper. Its adaptation as a substitute for rags and other materials now used will be easily demonstrated. 1. Because of the bulk of pure available fibre it produces, the stems attaining the height of from eight to ten feet, even under ordinary cultivation, the only loss in weight being in the separation of the mucilaginous matter which they contain. 2. Because of the permanency of the crop, and the tendency of the root to stool like the willow, thereby producing with its age a greater number of stems, the strength of which may be easily upheld by the application of portable or liquid manures. When the crop requires renewal, the roots, which contain a large amount of farina, should be bruised in the manner of making starch from the potato, and the fibre left is at once suited for the fabrication of a quality of paper even stronger than that which can be produced from the stems; the farina being also available either as a substitute for starch or food for animals. It is also known that the hollyhock contains a large amount of colouring matter, which, being little inferior to indigo, might also be extracted, and thus the whole plant appropriated to useful purposes. Its suitability for the manufacture of rope is alone sufficient to cause it to be extensively cultivated, an acre of plants, when established, producing from three to five tons of available fibre for this purpose. The average quantity of fibre suited for the paper manufacture per imperial acre will be about fifteen tons; this arises from the inner part of the stem being pulped down with the outer fibre.

2. On the Swedish Safety Lucifer-Match. Communicated by the President. The match was exhibited.—The safety lucifer-match is the invention of Lundstrom, a Swede, who has a large match manufactory at Jonkoping, in Sweden, where some hundred workmen are employed, and eight or more millions of matches are produced daily. They are about to be introduced into this country by the firm of Bryant and May, London, who are the largest importers of German and Swedish lucifers in the kingdom. A patent has been taken out in their name for the sale in England of the Swedish match. Its peculiarity consists in the division of the combustible ingredients of the lucifer between the match and the friction-paper. In the ordinary lucifer, the phosphorus, sulphur, and chlorate of potash or nitre, are all together on the match, which ignites when rubbed against any rough surface. In the Swedish matches these materials are so divided that the phosphorus (which is employed solely in the amorphous state) is placed on the sand-paper, whilst the sulphur, and a minimum amount of chlorate, or nitrate of potash, is placed on the match. In virtue of this arrangement, it is only when the phosphorised sand-paper and the sulphurised match come in contact with each other that the ignition occurs. Neither match nor sand-paper, singly, takes fire by moderate friction against a rough surface. The matches are thus much less liable to cause accident by casual ignition than the ordinary ones; and the recent edict by the Spanish Government against the employment of lucifers by the peasantry of the forest districts in dry weather (which will certainly be evaded) would be needless, if the Swedish matches were in general use. If they fully answer the announcements of the inventor, and it is due to him to acknowledge that they excited great interest at the Exhibition in Paris last summer, they will soon displace the common lucifer, in virtue alike of their manufacture being much less injurious to the health of the workmen who make them, and to the property of those who use them.

3. Description of an Apparatus for Seeing Through Tubular Drains from the Surface of the Street. By James Leslie, Esq., C.E., Vice-President R.S.S. Arts. A model and drawings were exhibited.—The apparatus exhibited, which may be considered as a model on half the scale which it would be expedient to adopt in practice, is for the purpose of affording the means of seeing, from the surface of the street, through underground tubular drains, which are too small for a person to pass through, and thereby enabling the observer, without his requiring to go down into any underground chamber, by looking towards a lamp or candle lowered down to another point in the line of drain, to see whether there be any sediment or other obstruction in the portion of the drain between him and the light. This is effected by looking down, with the help of a telescope of small power, to a mirror, set at an angle of forty-five degrees in the lower end of a light metal tube, say six inches diameter, and lowered down from the surface of the street to the axis of the drain-pipe, through a fixed vertical pipe or eye, a light being lowered down another and similar vertical pipe, whereof there must necessarily be one at every bend or change of gradient in the drain.

4. Suggestion for the introduction of the Parisian "Crochet," for the use of street-porters. By Colonel Graham Graham of Jarbruck, Moniaive.—This was a suggestion for the introduction, for the use of street-porters, of what, in Paris, is called a *crochet*, a very simple and cheap contrivance (as one can be constructed for 2s. 6d. to 5s.), curved on the back, which has the effect of throwing the load off the spine, and causes it to rest on the limbs, thus enabling the porter to travel much more comfortably even under a greater load that that usually carried in this country.—Mr. Sang remarked that a somewhat similar machine, of even simpler construction, was in daily use in Constantinople, and that it was astonishing how great a load a Turkish porter can carry, the pressure been thrown entirely upon the limbs and not on the spine.

Home Correspondence.

DR. APELT'S METHOD OF PRESERVING WOOD.

Sir,—We beg your indulgence for a few remarks upon the article which appeared in your last number respecting a process for the preservation of wood, suggested by Dr. Apelt, of Saxony.

We do not wish to discuss the principle of Dr. Apelt's invention. The theory upon which it is based is not a new one. All the timber-preserving processes in which chemical salts have been the agents employed, viz.—Kyan's, Margary's, Payn's, and Sir W. Burnett's, have been founded upon the two following ideas:—

1st. That the tannin of wood has a chemical affinity for certain salts, which, uniting with it, form an insoluble compound, preventing the admission of air and moisture; or, 2nd. The opinion of Sir Humphrey Davy, that a chemical salt which would produce a coagulation of the albumen, would obviate the liability of timber to decay. All these processes, however admissible in theory, and though, to a certain extent, and under certain circumstances, efficacious, have been more or less abandoned in practice.

As the Dr. states, "humidity withdraws the substance again," and we have yet to learn whether this is not the case with his own process, or whether the "slowly progressing mineralisation," of which he speaks, is of a more durable nature, and of a practical and economical application.

But we are astonished that Dr. Apelt has not alluded to the process which has been, of all others, the most extensively and the most successfully adopted. The process of *creosoting* timber is so well known to the engineering world in England, that it will not be necessary to enter into a lengthened description of it here. It will suffice to mention that it does not change the nature of the wood, as was attempted to be done by the other methods. It introduces an antiseptic substance into the pores, taking the place of the natural sap, and thoroughly impregnating the texture of the timber wherever it enters. It prevents the formation of the fungi-producing rot, whilst, from its bituminous and oleaginous nature, it forms an impenetrable sheath against the access of those formidable agents of the destruction of woody fibre—air, humidity, and the attacks of insects.

This process is now of almost universal adoption for railway and other great public works in England, and is very extensively used on the Continent. It has stood the test of time and experience for a period of more than fourteen years, without a single recorded instance of failure when the process has been properly carried out. We have but to cite, amongst numerous other instances, the case of the Scotch fir sleepers, which were creosoted and placed on the Eastern Counties Railway in 1842, and which were exhumed during the present year, without presenting the slightest appearance of decay.

We think, therefore, we are justified in commenting upon the circumstance, that Dr. Apelt ignores the existence of a process which completely carries out the end which he proposes, and which is of such general application; and we fearlessly join issue with him on his conclusion, that all other processes but his own are transient and incomplete in their operation, and of too recent a date to produce reliable results.

In conclusion we beg to say that, as contractors, who have been engaged for many years past in carrying out, both in England and on the Continent, the various processes which scientific men have from time to time invented for the preservation of timber, we do not presume to put forth our own opinion merely on this important subject. If we cite the fact of one process being adopted in preference to another, it is because the concurrent judgment, observation, and experience of the leading engineers of the age has directed our labours in that direction, and practically solved the problem whether timber exposed "between wind and water" can be effectually preserved from decay.

We are, &c.,
H. P. BURT and CO.

P.S.—The process of creosoting timber is fully described in the "Formules" of Mons. J. Claudel, a text book for engineers, much referred to on the Continent.

INTERNATIONAL CURRENCY.

Sir,—Your *Journal* has claims to be regarded as a depository of information on this and cognate subjects as they transpire.

It is reported from Vienna that the Prussian representative at the Monetary Congress there, Finance-Councillor Seydel, has gone to Italy with a view still further to extend the relations now proposed to be established between the German standards of weight and value on the one hand, and those of the French metrical system on the other.

Those who have retarded the decimalisation of our own established moneys, weights, &c., in the vain hope to establish identity among the currencies of all nations will probably feel disappointed that nothing more is likely to be attained, notwithstanding that several conventions have been held for reducing the discrepancies among the monetary systems of Germany, from 1690 down to the present day.

In 1838 the Dresden Convention effected a certain correspondence between the divers coins, and rendered them conveniently commensurable by each other; still, for the several reasons given in my paper in your *Journal* of 16th February, 1855, the Convention could neither ensure uniformity at the divers mints, nor enforce the indiscriminate reception of national coins beyond their own frontiers.

It was, nevertheless, an important step gained when, disregarding the disparities acknowledged to exist between the mark weights of German states, so many of those states adopted the Cologne mark as a common mint standard. Thus, since the Dresden Convention above referred to, the Cologne mark of pure silver has been at once the contents, equivalent expression, or common value of—

14 Prussian thalers.
21 Austrian florins (old).
20 Do. do. since 1838 (C. M.)
24½ Rhenish florins.

Of late years the German Customs Union (Zollverein) has adopted for international purposes a zoll-centner, or cwt. of 100 French ½-kilogrammes, or zoll-pounds; and Prussia, since the 1st July current, adopts the same weight for its internal trade. It is now proposed to substitute this zoll pound for the Cologne mark, as a standard mint weight.

In order to facilitate this arrangement, Austria contemplates reverting to her old florin, of which 21 = 14 Prussian thalers. The following would then represent the scale of equivalents:—

A zoll-pound, or ½-kilogramme of pure silver, would be coined into

30 Prussian thalers.
45 Austrian florins.
52½ Rhenish florins.
111⅑ French francs.

The debasement of the German standard of value, to be caused by this alteration, has been much exaggerated by rumour. Since the Cologne mark is estimated by the French mint at 233·855 grammes (the Germans claim for it 233·860 grammes), I estimate that it will require from 100,223 to 100,225 of any of the proposed new German coins to produce as much pure silver as is contained in 100,000 of the existing coins. In other words, the German monetary standard would be debased to the extent of, say 2¼ per mille, *i.e.*, 4s. 6d. per £100.

For estimation of the par of exchange, the following table of equivalents may be found useful:—

1000 francs.
270 Prussian thalers.
405 Austrian florins.
472½ Rhenish florins.

That "fixed equivalents" between the silver standards of Germany, France, &c., and the gold standards of Great Britain, the United States, &c., are a mere chimera, should, after the discussions in your columns, be obvious to all. Still, as a convenient datum, the artificial par of exchange, 25 francs per £1, supplies the following tables:—

		1000ths of £1.
1 franc	=	40
1$\frac{1}{80}$ P. thaler	=	150
1$\frac{1}{80}$ A. florin	=	100

In other words, 1 Prussian thaler, plus 1¼ per mille, equals 3 shillings, or, more correctly, $\frac{3}{20}$ths of £1, *i.e.*, 150 English mills; and the Austrian florin, plus 1¼ per mille, equals the $\frac{1}{10}$th of £1, represented by the English florin, *i.e.*, 100 mills:—

Artificial par of Exchange.

25 francs	per	£1
6⅔ P. thalers	per	do.
10⅛ A. florins	per	do.

The extension of the sphere of the kilog. should rejoice all those among the advocates of international standards who will condescend to be practical, and abstain from insisting that we shall never be enabled to compute English moneys, weights, &c., by simple or common arithmetic, until the nations of the earth shall have submitted their cherished standards to some procrustean process yet to be devised.

Let them be content with the simplifying of relations between weight and measure standards of old countries, expressed by some accepted formulæ of equivalents in international commerce. Perchance in time (as with Prussia, if its new plan effect the object in view) international standards may become domestic ones also.

Meanwhile, I have already shown, in your *Journal* of 15th Feb., 1856, that Great Britain, her colonies, the United States, and other exporting countries using the ℔ avoirdupois of 7,000 grains, will find 63 cwt. avoir. equivalent to 64 cwt. of the Zollverein, *i.e.*, 3,200 kilogs., and 441lb. avoir. equivalent to 200 kilogs., within a mere $\frac{1}{80}$ per cent., and I maintain, once more, that to decimalise the £ and the ℔, would be intermediately necessary, even though international standards were near at hand.

Yours, &c.,
J. A. FRANKLIN.

Warnford-court, 31st July, 1856.

NEGATIVE ARTESIAN WELLS.

Sir,—In an article on "Negative Artesian Wells," by Dr. Bruckmann, in the last two numbers of the *Journal*, I find the author taking great credit for introducing the subject of absorbing wells as a novelty in this country.

If he will be good enough to refer to the second volume of a work on Geology, published by me in 1844, he will find the subject referred to, and illustrated by engravings, in fewer words indeed than those he has now used, but perhaps clearly enough to convince him that England is not so much behind-hand in this matter as he supposes. The reference alluded to is in page 503, and suggests an employment of absorbent wells to which your correspondent does not allude.

I remain, &c.,
D. T. ANSTED.

17, Manchester-street,
August 1, 1856.

EDUCATION FOR GIRLS.

Sir,—Education is much indebted to Lord Ashburton for his introduction of the phrase "*common things*." His lordship might have advanced another step, by asserting that the commonest things depend upon science for their due and economical execution. The Dean of Hereford obtained scientific instruction for the school at Kingsomburn. Dr. Booth has likewise succeeded in introducing it for boys; and Professor Henslow has taught it to girls as well as boys, as noticed in the *Gardener's Chronicle* for the last and present month; but these are, it is believed, the only instances of scientific instruction being afforded to the poorer classes of children. And yet how useful it is in the most ordinary operations. For instance, in making tea, chemistry teaches us that the aroma of the beverage being an essential oil, it evaporates at a boiling heat, and, therefore, the water used should not be allowed to attain that heat; whilst, on the contrary, teaine is best extracted at a boiling temperature. About a century ago, Sir Humphrey Davy, in a lecture delivered at the Royal Institution, said that a silver teapot made better tea than one of Wedgewood's ware, but he knew not why. The radiating powers of polished surfaces have since then been discovered. Cooks soon ascertain that a black saucepan heats quicker than a bright one; and thus endless might be the proofs of the necessity of applying chemistry to "common things."

I am, &c.,
M. S. BENTHAM.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August* 1*st*, 1856.]

Dated 15*th July*, 1856.

1658. Jean Louis Lucas and Albert de Briges, Paris—Improvements in preparing certain liquid or solid alimentary substances from the husk of a certain fruit.

Dated 16*th July*, 1856.

1668. William Schmidt and Edward Schmidt, Heidelberg, Baden—An improved balance for weighing.

1670. Henry Turner, Leeds—Improvements in cutting hides for making flexible pipes, and for certain other purposes.

1672. Alfred Vincent Newton, 66, Chancery-lane—Improved apparatus for obtaining rotary motion. (A communication.)

1674. Thomas Duncan, Liverpool—A combined and compound engine for applying motive power, and for measuring fluids.

1676. Duncan Cameron, Glasgow—Improvements in cranes or lifting and lowering apparatus.

1678. George Eskholme and Henry Wilkes, Rotherham—Improvements in ball cocks and cocks in general for drawing off fluids.

Dated 17*th July*, 1856.

1680. Charles Barlow, 89, Chancery-lane—An improved surveying instrument. (A communication.)

1681. Henry Bragg, jun., Belfast—Improvements in drying air, and in machinery for stretching, drying, and finishing fabrics.

1682. Frederick Andrew and Samuel Forsell, Manchester—Certain improvements in machinery or apparatus for sizing, stiffening, dressing, and polishing yarns and threads.

1684. Rev. George Jacque, Auchterarder, Perth, N.B.—Improvements in the construction of stringed musical instruments.

1685. Ebenezer Seymour, Blomfield, New Jersey, U.S.—Improvements in the construction of furnaces. (A communication.)

1686. Alfred Vincent Newton, 66, Chancery-lane—An improved regulator for heating apparatus. (A communication.)

1687. Charles Carey, 48, Bessborough-street, Pimlico—Improvements in the vessels and filters used for making infusions of coffee and other substances.

Dated 18*th July*, 1856.

1689. Samuel Jay and George Smith, 246, Regent-street—Improvements in the manufacture of skirts, petticoats, mantles, and such like articles of ladies' dress.

1692. George Frederick Hipkins and John Britten, Birmingham—Improvements in applying springs or weights for the purpose of closing doors, or resisting shocks, strains, or pressure.

1693. John Cowley, Quenington, Gloucestershire—Improvements in the manufacture of paper from straw and other vegetable substances.

1694. Peter Hubert Desvignes, Lewisham—Improvements in machinery for scutching or beating flax, hemp, and other fibrous materials requiring like treatment.

1695. Jean Gerber, Mulhouse, France—Improvements in printing, dyeing, or impregnating fabrics, yarns, and threads, and in preparing metallic and other powders to be used for these purposes.

1696. William Beevers Birkby, Upper Rawfolds Card Works, Cleckheaton, near Leeds—Improvements in filleting and fixing pointed teeth in the fillets used in the preparation of flax, tow, hemp, and other fibrous substances.

1697. John Hamilton, jun., Liverpool—An improvement in the bending of sheet iron for the manufacture of conical tubes.

Dated 19*th July*, 1856.

1698. William and James McMaster, Manchester—An improved apparatus for retaining and releasing cords of window blinds, or cords, bands, or chains employed for other purposes.

1699. George Hopper, Houghton-le-Spring Iron Works, Durham—Improvements in railway pins or spikes.

1700. John Armour, Kirkton Bleach Works, Renfrew, N.B.—Improvements in bleaching, washing, or cleansing textile fabrics and materials.

1701. James Lawrence Crockett, West Ham—Improvements in evaporating. (A communication.)

1702. William Noton, Oldham, Lancaster—Certain improvements in self-acting mules, and other machines of the like nature for spinning and doubling.

1703. James Ryder and Samuel Bentley, Bolton-le-Moors, Lancaster—Improvements in machinery and apparatus for folding and measuring fabrics.

1704. William Stettinius Clark, 19, Warwick-street, Charing-cross—Improvements in machinery or apparatus for digging, pressing, and moulding peat. (A communication.)

1705. James Lawrence Crockett, West Ham, Essex—Improvements in the manufacture of sulphuric acid. (A communication.)

1706. John Whitehouse, jun., Birchall-street, Birmingham—Certain improvements in making, mounting, and spindling knobs, applicable for doors and other purposes.

1707. William Astbury Jump, Moulton, near Northwich—Improvements in the manufacture of salt.

1708. William Astbury Jump, Moulton, near Northwich—Improvements in apparatus for supplying with fuel the furnaces of steam boilers and other furnaces, and in the method of cleaning the fire-bars thereof.

1709. John Smith, Oldham, and Enoch Harrison, Manchester—Improvements in machinery or apparatus for warping and beaming.

1710. Edward William Young, 22, Maidstone-road, Rochester—Improvements in the construction of bridges.

1711. William Papineau, Harrowbridge, Stratford—An improvement in the production of spirits of wine.

1712. Richard Archibald Brooman, 166, Fleet-street—An improved method of supplying air to gas and other lights. (A communication.)

1713. Henry Jeremiah Iliffe and James Newman, Birmingham—Improvements in the manufacture of buttons.

Dated 21*st July*, 1856.

1714. James Warren, John Jones, and Benjamin Crowther, Clapham-road—An improved churn.

1716. Marc Antoine Augustin Gaudin, and Eugène Xavier Choumara, Paris—Manufacturing factitious wholesome milk.

1718. John Pursloe Fisher, Edgebaston, near Birmingham—Improvements in cues used at billiards, bagatelle, and other similar games.

1720. Robert Richardson, 26, Great George-street, Westminster, and Jonathan Edwin Billups, Llanelly, South Wales—Improvements in the permanent way of railways.

1722. Frederick Simpson, Redhill, Surrey—An improved mode of stopping bottles.

1724. William Green, York-street, City-road—Improvements in treating, ornamenting, and waterproofing fabrics, and in machinery or apparatus for effecting the same.

1726. Samuel Statham, Islington, and Edward Orange Wildman Whitehouse, Brighton—An improvement in the arrangements for or working of electric telegraphs.

Dated 22*nd July*, 1856.

1728. Alfred Vincent Newton, 66, Chancery-lane—Improvements in machinery for reaping and mowing. (A communication.)

1730. Samuel Colman, Norwich—Improvements in steam boilers.

1732. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in lighting and extinguishing gas lights. (A communication.)

1734. Henry Hindle, Cavendish-street, Ashton-under-Lyne—Improvements in valves and apparatus for governing steam-engines, and for increasing the safety of steam-boilers.

1736. John Imray, Bridge-road, Lambeth—Improvements in bending timber.

Dated 23*rd July*, 1856.

1738. John Brayshay, Cinderhill, Ringley-bridge, near Bolton-le-Moors—Certain improvements in boilers for generating steam.

1746. Giles Mabie, Rockford city, Winnebago county (state of Illinois), U.S.—Improved machinery for mowing and reaping. (Partly a communication.)

1750. John Webster, 1A, Moreton-terrace, Pimlico—Improvements in distilling and treating rough turpentine and resinous matters.

1752. Pierre Charles Prévot, Agen, France—An improved railway break.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1742. John Onions, Wellington-place, Blackfriars-road, Southwark—Improvements in the manufacture of iron.—23rd July, 1856.

1792. Robert Thatcher, Oldham—Certain improvements in preparing for doubling or spinning cotton or other fibrous substances.—29th July, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 31*st*, 1856.

257. Henry Holford and Mark Mason.

Sealed August 1*st*, 1856.

311. Theodore Bergner.
321. John Fletcher and William Fletcher.
327. James Edward Duyck.
431. John Freer.
435. Jeremiah Clark and James Austin.
447. James Durell Greene.
459. George Toucas.
499. Peter Armand le Comte de Fontainemoreau.
505. Thomas Taylorson Jopling.
567. Auguste Neuburger.

Sealed August 5*th*, 1856.

318. George Napier and John Miller.
328. Charles Frederick Philipp Funcke.
364. Louis Vignat.
368. William Gilchrist.
370. William Edward Newton.
374. Gustave Louis Keller.
378. Henry Robert Ramsbotham and William Brown.
398. William Edward Newton.
406. James Strang Thomson and Andrew Barclay.
494. Richard Archibald Brooman.
548. Richard Archibald Brooman.
570. John Downie.
931. George Thompson.
908. Thomas Hill.
1076. Louis Guillaume Perreaux.
1088. Alfred Vincent Newton.
1150. James Leck and Alexander Miller.
1252. Alphonse Réné Le Mire de Normandy.
1266. Frank Clarke Hills.
1326. Frederick Albert Gatty.
1350. Charles Durand Gardissal.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

July 28*th*.

1775. James Edward McConnell.
1823. Charles Butler Clough.
1843. Robert Morrison.

July 29*th*.

1779. William Thomas Henley.
1789. John Carvalho De Medeiros.
1852. William Rowan.

July 30*th*.

1832. George Armitage.

July 31*st*.

1897. John Perkins.

August 1*st*.

1825. Thomas Muss.

August 2*nd*.

1829. William Smith and Thomas Phillips.
1831. William Smith and Thomas Phillips.
1887. Richard Archibald Brooman.

Journal of the Society of Arts.

FRIDAY, AUGUST 15, 1856.

◆

ON NEGATIVE ARTESIAN WELLS, OR ABSORBING BORED WELLS, AS A MEANS OF DRAINING LANDS, FARMS, BUILDINGS, &c.*

By Augustus Edward Beuckmann, Ph. Dr., Consulting Engineer and Geologist.

(*Concluded from page* 638.)

As soon as I had thus ascertained that the disclosed negative stratum was capable of absorbing far more water than could penetrate into the shaft at any time, even under extraordinary conditions of weather, the chief problem was solved, and I at once proceeded to enlarge the bore, the total depth of which now amounts to 76 feet 8 inches 2 lines from the surface. I fixed its diameter at 5 inches, and after this increase was made I lowered metal tubes, in order to prevent the sides collapsing. These tubes were pierced with small holes, corresponding with the absorbent stratum. In order to tap and drain the ground between the shaft and the retaining wall of the cellar, I carried from out the shaft three holes, in a slightly ascending direction, into the wet marl bed (lying, as has already been stated, at the depth of between 19 and 25 feet) to the retaining wall (see Plates I. and II.) This was successful in completely draining the intermediate ground.

The boring work was thus successfully completed, but before my departure from Stetten, on the 10th of December, 1852, I made arrangements for taking out the timber with which the shaft was lined at *a a a*, and for erecting the necessary masonry, &c., as may be seen on Plate II. Care was also taken to leave means for clearing the hole with a scouring-bit ("Löffel"), if, contrary to all expectation, its stoppage should at any time occur, and for such a purpose the tubes would serve as guides.

In the section Plate II., the general geological groups only are indicated, but not their single strata, because the latter are described below. The subterraneous current and its level are denoted by shading.

The column in the bored hole, continually replenished by the percolating water, does not quite fall to the level of the absorbent stratum, but after several oscillations its level has taken a position of 58 feet 5 inches below the surface of the soil. In the disclosed negative stratum, a current of water moves from south-east to north-west, and, if we compare the latter to a communicating tube, this perforation represents a natural piezometer,[*] which would even have served *for a positive artesian well under other local circumstances, that is to say, in a lower situation of the soil.* The water of this absorbent stratum must be in communication with the outbreaks of springs in the deeper lying valley of the Lone, or, extending our notions, with the powerful Buch spring, rising at the bottom of the mountain castle of Burgberg, three and a-half English miles from Stetten, where that spring breaks forth with great force in the bottom of a valley out of a rock of coral rag, similar to the sources near Aach, Urspring, Honau, Blaubeuren, Königsbronn, Aalen, and Gössweinstein, already mentioned.

The geological and hydrographical section of the above-mentioned bore shows, in descending succession, the following strata:—

	Wirtemberg.[*] Ft.	In.	Lines.
ALLUVIUM.			
Rubbish (of buildings)...........................	2	5	0
MIOCENE MARINE MOLASSE.			
Rusty brown clay, towards its lower part passing into greenish brown loose sandstone (molasse); a thin layer of the molasse of Niederstotzingen	10	5	0
FRESHWATER BED OF THE MOLASSE.			
Compact crumbling yellowish gray calcareous marl, with rusty yellow streaks, enclosed pebbles of jura limestone (coral rag), and a few fragments of land and freshwater shells	16	0	0
Closely pressed masses of compact whitish marl, the intervals filled with greyish white tenacious clay; passing into compact clay marl, with nodules of hornstone	25	0	0
Compact blueish grey clay marl, spotted with rusty brown and rusty yellow,[†] with numerous pebbles of jura limestone of different sizes, nodules of horn-stone, and some silicified zoophytes of the genus "Scyphia;" they occur here, though originally belonging to the upper jura formation. No water in this deposit. The pieces of limestone and the boulders became larger as the depth increased ...	32	9	2
Somewhat loose blueish grey and yellow spotted (dry) clay marl, with pebbles of jura limestone, and horn-stone of the size of an egg, sometimes of a fist, crowded together as a conglomerate..................	37	9	2
Porous rusty yellow and reddish speckled stony marl..	38	4	3
Porous yellowish and reddish speckled stony marl, with a few small pebbles of jura limestone, passing into reddish yellow clay marl, with blueish grey spots, and containing some small pebbles of coral rag. Very tenacious, and not in the least sandy	48	9	9
Compact whitish argillaceous limestone (freshwater limestone), without pebbles	50	7	9
Reddish yellow, blueish grey spotted tenacious clay marl, with small pebbles of limestone	53	7	9
Compact whitish argillaceous limestone ...	55	2	7
Tenacious yellowish clay marl	55	5	7
Compact argillaceous limestone, with a hard basis	57	8	0
Blueish yellowish spotted and somewhat sandy clay marl, with small pebbles of limestone	58	8	0
Hard stony marl (freshwater limestone) ...	59	0	9

N.B.—Out of this mass, from the depth of 19 feet, the percolating water entered the shaft from the east, while the bed below the depth of 25 feet was dry.

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[*] Compare my German edition of "Viollet's Théorie des Puits Artésiens," with appendices by me; or see the original work, "Théorie des Puits Artésiens, suivie d'une instruction pratique très-étendue sur les moyens d'utiliser ces puits dans les arts et dans l'agriculture; par J. B. Viollet, ingénieur civil hydraulicien, spécialement pour les opérations d'art et les mémoires contentieux relatifs aux litiges qui s'élèvent sur l'usage industriel des cours d'eau; membre de la Société d'encouragement pour l'industrie nationale, &c., &c., Paris. 1840." According to a communication made to me by Mr. Viollet in a letter, a second edition of this work has now been published

[*] 100 Wirtemberg feet correspond to 94·573 English feet.

[†] Corresponding with several marls of the freshwater formation, which I perforated in the year 1835, while establishing three (positive) artesian wells for Francis Count of Castel-Dischingen, &c. See my work, "Die denkwürdigen artesischen Brunnen zu Ober Dischingen in Württemberg, in geognostisch-hydrographischer und constructiver Beziehung. Mit einer Steintafel. Heilbronn am Neckar, J. D. Classische Buchhandlung, 1836."

	Ft.	In.	Lines.
Tenacious yellowish clay marl, passing into compact stony marl, with pebbles of jura limestone, several of which, at a depth of 62 feet 7 inches, fell in during the boring, and set fast the borer, but it was always readily loosened again in a few minutes. Some pebbles of the size of eggs were brought up	63	2	1
Compact tenacious clay marl, yellowish colour prevailing, but a few blueish spots	66	3	3
Hard marl slate (slaty freshwater limestone)	66	7	3
Absorbent stratum, or subterraneous current of water, which the borer rapidly cut through; filled with sand and pebbles of jura limestone; also some pieces of clay marl which had fallen in. The water, accumulated in the shaft, began to sink, and had soon disappeared. In the course of clearing this stratum many pebbles, together with sand, were brought up with the scouring-bit ("Löffel")......	69	7	2
JURA FORMATION.—A.—PORTLAND DEPOSITS.			
Hard whitish stony marl	70	1	3
Tenacious greyish white clay marl	72	5	5
Compact whitish stony marl	73	7	5
Tenacious greyish white clay marl	74	8	2
Very compact whitish stony marl, passing into very tenacious greyish white clay marl, with small pebbles of jura limestone	76	1	8
B.—CORAL RAG.			
Very hard coral rag; basis of the series ...	76	8	2

The thickness of the single strata can easily be found by simple subtraction.

The mass of marl brought up in sinking the shaft was thrown together in a heap, for the convenience of applying it, when required, to the manuring of marshy meadows.

ABSORBING BORED WELL IN THE OLD ALE-CELLAR.

I have already observed that this boring was executed during the sinking of the shaft at the new cellar. It was necessary to hasten it, because the old cellar has always to be first filled with beer, and the chief matter in question proposed to me was, first of all to try, by an experimental perforation in the cellar itself, whether, through the latter, it might be possible or not to carry off the water which entered along its eastern abutment, "Widerlagermauer." Up to this time, namely, in the old cellar, there was a reservoir lined with masonry, placed at *a* (see Plate I.), into which the water entering the cellar flowed, by means of gutters in the floor. At that spot, whenever the reservoir was full of water, it was drawn into casks, which had to be rolled from *a* to *c*, in order to be raised, by a crane placed above, through the opening at *c*, which served for letting down and raising the beer barrels. If this tedious and troublesome operation was not regularly performed in good time, the reservoir overflowed, and by degrees the whole bottom of the cellar was covered with stagnant water,* emitting a nauseous smell. The same thing happened sometimes in the new cellar, whenever they had neglected to pump the water out of its reservoir at *b*.

I now come to the boring immediately in the old cellar itself, though I did not quite agree with this proceeding, for I should have preferred, as a more rational mode, first to wait for the result at the new cellar, and then, in any event, to intercept the water on the outside, and carry it down as I had done in front of the new cellar. By this means I should have preserved its masonry, and drained it perfectly. However, circumstances rendered it desirable, in some respects, to adopt this plan, and I was urgently requested to undertake it. The success may be called a fortunate one, the more so as a further improvement of it may, without doubt, be made at any future time.

We proceed to an account of this boring and its result.

First of all I directed a pit to be cut out, 3 feet 8 inches deep, and 4 feet square, perpendicularly, under the centre of the opening at *c*, and in the porch of the cellar, into which a wooden tube was inserted perpendicularly, and fastened in it. This spot was the most fitted for the perforation, for the aforesaid opening, 22 feet 4 inches 3 lines deep, over which a verandah is built, afforded sufficient space to let down and pull up the borer, together with the boring rods (iron bars); and the crane already placed above, and serving to raise and lower beer barrels, could conveniently be used for my purposes.

The newly-made sink-hole at *c* stands in a greyish white and compact argillaceous limestone, occasionally penetrated by small veins of greenish grey clay; it is a real freshwater limestone, but I could not discover any fossils in it, while the latter frequently occur in the freshwater limestone of the environs, even near the neighbouring town of Niederstotzingen, belonging to the genera *Helix*, *Planorbis*, *Cyclostoma*, *Limnaea*, &c. The freshwater limestone, together with its marls (it is itself for the greatest part nothing but a stony marl), constitutes the outermost southern hills and mountains of the Alps near Ulm, and the adjacent plateaus of the mountains at that place.

While the bottom of the new cellar, at its eastern retaining-wall, is situated 27 feet 3 inches under the surface, that of the old cellar, at the opening, *c*, lies only 22 feet 4 inches 3 lines under the soil, and the horizontal distance from the perforation at the former to that of the latter amounts to 133 feet, in a south-western direction, as may be gathered from Plate I.

On the 12th of October, 1852, the boring in the old cellar was begun—in the fresh-water formation. I must premise, that much less water (likewise coming from the east-side of the fir-wood) entered this cellar than the new one, before it had been provided with its negative artesian well, and the water in the former increased noticeably only in the time of heavy showers of rain. According to my own observations, the most rain-water always came in at the spot *d*, (see Plate I.) and ran off together with the drainage water to the pit *a*, which, after all, was not conveniently placed. After the boring in this cellar was finished, of course it was done away with entirely.

When, between the depth of 28 feet 7 inches 3 lines and 38 feet 4 inches 3 lines (measuring from the surface of the soil), compact white stony marls had been cut through, in which a cavity of one inch in depth occurred, as may be seen in the description of the geological section further back, water *poured* into the bored hole began gradually to sink down. The new sink-hole was now quite filled with water, and I perceived that even this water had entirely disappeared after six days. This slow absorption was, of course, not sufficient for the intended purpose, and, continuing the perforation, after a stratum of very hard freshwater-limestone was cut through, a sandy marl, 2 feet 5 inches 2 lines thick, was disclosed at a depth of 43 feet 1 line, in which the chief absorption of the water takes place, although the boring was carried down to a total depth of 52 feet 8 inches 6 lines.

I made several experiments with reference to the water *poured* in, but I must confine myself to giving here only the most important results.

On the 28th of October, in the afternoon, at half-past one o'clock, so much water was poured into the bored hole, that the level of the column stood 27 feet 2 inches 3 lines below the surface of the earth; in the evening, at eight o'clock, it had sunk down to 35 feet 2 inches 3 lines, and on the 29th of October, at six o'clock in the morning, the level stood 37 feet 1 inch 3 lines below the surface. We see that, according to hydrostatic laws, the sinking of the water took place with decreasing velocity, as was the case in the first perforation already described.

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* As the brewer's men told me there, "The water grew mouldy or covered with a thin white film."

The level of the water *poured* into the bored hole on the 29th of October at six o'clock in the evening, settled at 36 feet 5 inches 8 lines below the surface, but during the night it fell down 3 feet 4 inches, thus, the diameter of the perforation having 4-tenths of a foot,[*] 427 cubic inches and 40 cubic lines of water sank, whilst in the very same space of time, in the old pit at *a*, only 194 cubic inches and 481 cubic lines of water accumulated; therefore, in that night, 232 cubic inches and 559 cubic lines of water more escaped in the bore than rose in the old reservoir. This reckoning, however, affords only an approximate result, for the quantity of water absorbed in the perforation must have been more considerable, because at the same time the new sink-hole at *c* took up the drainage-water coming in at *d*, and let it into the hole.

After such pleasing results, although they cannot be compared with those obtained at the new cellar, on the 2nd of November, I had *all* the drainage-water accumulating in the cellar conducted provisionally into the new sink-hole, and consequently into the bore itself. In doing so, the arrangement was made so that not a drop more water could pass into the old reservoir at *a*, moreover, the new sink-hole, and along with it the perforation, was filled with water again, and in an hour's time 947 cubic inches and 100 cubic lines of the water thus collected went off from the pit. The column of water sank by degrees from 40 to 43 feet deep below the surface of the soil, and slowly oscillated up and down in this position.

These proofs, witnessed partly by the Count of Maldeghem, partly by his steward, Mr. Keller, admitted of the supposition that the absorption in the bored hole, though slow, was yet sufficient, even if the quantity of the percolating water in the cellar should, by any chance, be doubled or trebled. On the 6th of November the boring-works were ended, and the perforation at the new cellar, already described, was undertaken after the shaft had been sunk; at the same time the bottom of the old cellar was relaid, so that all the entering water flows through channels with a gentle descent directly into the new sink-hole at *c*, that is, into the bore. By this means the old reservoir at *a*, besides being very ill situated, was entirely superfluous, and was therefore filled up and covered with squares of stone, like the bottom of the cellar.

The strata of ground cut through in the old cellar proved sufficiently compact to render it unnecessary previously to sink a protecting-tube into the bored hole; but in order, as far as possible, to prevent the stoppage of the latter with mud from the dirty water, I directed a tube of sheet-copper to be made, 3 feet long, and pierced with fine holes, having on the top a handle and neck, and at the bottom a valve, like a scouring-bit. This hollow copper-cylinder was suspended in the bore-hole at the bottom of the new sink-hole after the wooden tube had been taken out. It is intended to collect the particles of mud from the water flowing in. From time to time it may be taken out and cleaned, which can be easily and quickly performed by means of the valve.

It may indeed happen, in the course of time, that by gradual and permanent softening of the penetrated marls, a stoppage of mud may take place in the bore, which would involve the necessity of opening the latter, with a scouring-bit, and of protecting it with metal-tubes, as in the first perforation at the new cellar. As I have already distinctly remarked, this work, in a technical point of view, can be considered only as provisional and experimental, though at present answering its purpose.

As long as I was in Stetten, that is, to the 10th of December, 1852, it never happened that the new sink-hole was quite filled with drainage-water, so as to render it necessary to bring it up in casks; even this, in the present position of the new sink-hole (at *c*), could be managed much more easily and quickly than formerly. The perforation has always received and carried off the drainage-water which entered. I perceived that in consequence of the heavy and almost continued falls of rain in the month of November, which gave rise to a considerable increase of water draining into the cellar, the column of water in the bored hole gradually rose higher and higher, and in the beginning of December, 1852, even in the new sink-hole itself, some water had accumulated. However, it seems never to have reached the upper edge of this pit, but to have sunk again by degrees, no doubt through the diminution of the rain. In general, the perforation seems to possess a sufficient capacity of absorption even in extremes of rainy weather; for as I inquired after the fate of my works from the Count's steward, Mr. Keller, more than a year afterwards (January 28, 1853), he sent me on the 3rd of February of the same year, the following agreeable communication:—

"*I am very much pleased with the state of your borings. The sink-hole in the old cellar always carries off the water satisfactorily, and the perforation at the new cellar is permanently absorbent, in such a degree, that in the interior of the cellar up to this time no percolation of water could be perceived.*"

As before stated, the perforation in the old cellar lies to the south-west, at a distance of 133 feet from that of the new cellar, and consequently the former somewhat nearer to the upper belt of the "Gemeinde" than the latter; with this trifling difference of distance one would have expected a tolerable similarity in the geological strata sunk through at both places, but it was not so, although the general character of the ground, fresh-water formation subjacent to marine miocene molasse, was the prevailing one; and here I must observe that the upper floor of both cellars (very little elevated above the surface of the earth) is situated at the same level.

The strata cut through in the old strong-ale-cellar are as follows:—

	Ft.	In.	Lines.
During the time of digging out the cellar they found, as I was told, clay marl with imbedded pieces of limestone, to a depth below the surface of	18	0	0
Here began the grayish white and compact argillaceous limestone (fresh-water limestone) free from fossils, penetrated by some veins of greenish gray clay, as has been already mentioned; the bottom of the cellar consists of this limestone, and the new sink-hole was cut out of it.	28	7	3
Compact whitish stony marl, with hard pieces of limestone imbedded.	35	7	3
A cavity, 1 inch deep occurred, in which the borer sank rapidly; *first, but slow absorption of water.*	35	8	3
Compact whitish stony marl.	38	4	3
Extremely hard fresh-water limestone passing into reddish colour, upon which the borer violently rebounded, and penetrated as slowly as in the hardest coral rag; no fracture of the borer, however, occurred.	43	0	1
Compact whitish marl, passing into bluish and yellowish spotted somewhat sandy clay marl, with enclosed small pieces of jura-limestone; *second, and principal absorption of water in this stratum*	45	5	3
Tenacious bluish and yellow speckled clay, with small pieces of jura-limestone.	46	5	3
Hard stony marl (fresh-water limestone)	47	4	3
Yellowish gray compact clay marl	49	5	6

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[*] In Wirtemburg the decimal measure is employed, a foot being divided into ten inches.

	Ft.	In.	Lines.
Extremely hard fresh-water limestone, as above, between the depth of 38 feet 5 inches 3 lines and 43 feet 1 line; end of the series	52	8	4

I must also draw attention to the circumstance that, during the establishment of both these borings, no communication could be discovered between the water in the shaft at the new cellar and the column of water of the perforation in the old ale-cellar, although it was to be expected, considering the trifling distance of these two points, and the constant endeavour of water to find its level. Thus, for example, on the 23rd of October, at six o'clock in the morning, the level of the water of the bore in the old cellar stood at 37 feet 1 inch 8 lines below the surface, whilst, at the same time, the level of water in the shaft at the new cellar was at 28 feet 6 inches below the soil, showing a difference of 8 feet 5 inches 8 lines, a phenomenon which is due to the dissimilarity of the beds of the two localities. Further, I must add that the absorbent strata at both points do not exert the slightest influence on the neighbouring springs and flowing wells of Stetten, as I had expected and had predicted immediately after the termination of my geological and hydrographical examination of that place.

The chief conditions of the successful negative artesian wells at Stetten have been now described; the future will confirm their advantage and benefit, and at once prove that under the prevailing circumstances and geological and hydrographical conditions of that place, now clearly made known by both the undertakings, any other mode of operation (*e. g.*, the driving of a tunnel or a gallery) would have been less successful, and in any case would have been far more expensive than my rapidly completed borings, during which no accident occurred. Both these undertakings, including all preparatory works and the construction of the shaft, took up only from the 27th of September to the 10th of December, 1852, and cost altogether about £200.

It is also obvious that the same complete success might with certainty have been obtained in the front of the old cellar as in the case of the new one, and that even the latter could, in a certain degree, be brought to a greater perfection. In my original German edition I made some remarks on this point, pp. 56—59, but I omit them here, as they are purely technical, in order not to become tedious to the reader. With respect to the new cellar, however, I cannot forbear observing, that according to a communication from the Count's steward, Mr. Keller, of the 12th of September, 1854, one of my proposed measures has since been put into practice, that is, along the southern and northern abutments of the cellar, on its floor and adjacent to the walls, small channels have lately been placed for a short distance, with a gentle fall to and round the retaining wall at *h* (see Plate I.). Through the latter a small drain, in combination with these channels, has been established, reaching into the shaft, so that, if heavy and unusually long rains should occur, or a deep snow should melt rapidly, and unexpectedly send some water into the cellar, the latter must flow off quickly to the shaft and sink in the perforation along with the continuously percolating water. Together with this communication I received a testimonial from the Count of Maldeghem.[*]

I have yet one other remark to make:—

In certain cases, and especially if the percolating water be of a good quality and occur in a large quantity, pump-wells can be established, together with negative artesian wells, in the following manner:—

When the shaft has been sunk, a water-proof tube should be forced down through the bottom for a certain distance into the ground (entirely depending upon the nature of the latter). If the bottom of the shaft should consist of rock, the tube must be inserted into it another way, but in any case it should be water-tight. Through the interior of this tube of course the boring must be made; now, if the water in the shaft has risen to a certain height, and the absorbent bore is finished, this tube must be provided with holes at the proper spot,[*] and through these holes the superfluous percolating water must flow into the absorbent bored hole, but the small holes pierced through the tube must always lie a little deeper than the bottom of the cellar, &c., to be drained. The water remaining behind in the shaft being continually renewed (the quantity depending on the depth of the shaft, and the more or less efficient percolation), could always be raised as wanted, by means of a pump to be placed down the side of the shaft. Such a combination may afford great advantages under certain circumstances and in certain localities, for agricultural, manufacturing, or domestic purposes.

FINAL REMARKS.

Although the negative artesian wells at Stetten show, on a comparatively small scale, only an example of what may be performed in more important and extensive cases, yet they show us the indisputable fact that such borings may be undertaken with much confidence of success, provided that the respective localities unite those necessary qualifications which must be always ascertained by a previous careful geological and hydrographical survey of the place, like that which I made in Stetten, before I undertook my perforations, and after I had pointed out the impossibility of establishing a positive artesian well in the garden of the castle at Niederstotzingen, for reasons which I have already given.

My own experience during many years has taught me, and the same inference may be drawn, no doubt, from the experience of England, that many more localities are fitted for establishing negative artesian wells than positive ones. If we are mindful of the great advantages the former afford for the purposes of agriculture, commerce, the purifying of the atmosphere, the draining of houses, &c., and, in proper positions, even of whole towns,[†] then it may be expected that public attention will be more surely directed to a plan involving such important consequences, and which, in suitable localities, can be carried out more simply and cheaply than the ordinary methods of drainage.

As it is well known that positive artesian wells can successfully be established in different parts of England, there can be no doubt that the important characteristics for the certain success of absorbing bored wells exist in many places, and on a more extended scale, than has hitherto, to my knowledge, been attempted. The British islands seem, for the purposes in question, to be more favoured by nature than any other country of Europe, for they are on every side surrounded by the sea, into which thousands and thousands of subterraneous currents must flow; and, moreover, they contain many very interesting changes of geological formations, positions, and disturbances, with elevations. Considering all these favourable particulars, I can only wish that I could be permitted to take in hand geological and hydrographical examinations, as well as actual works, in order to make use of that experience in my favourite pursuit, gathered in different countries and formations of Germany and France during some twenty years, and to show, by establishing negative artesian wells in England, what may frequently be done in a simple way, for draining purposes, if we properly make use of the advantages offered by nature.

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[*] *Testimonial*:—"In consequence of the percolation of water into my strong-ale-cellar at Stetten, not only were the flavour and quality of the ale frequently injured, but also the barrels to a very great extent. I, therefore, requested the engineer and geologist, Dr. Bruckmann, of Stuttgart, to remove this evil. On the 27th of September, 1852, he began to establish an absorbing bored well, the construction of which he finished on the 8th of December, 1852, with care, unwearied activity, and prudent economy. This performance of his was crowned with the happiest success, for, since that time, the percolating water is absorbed by the shaft sunk by him, and the cellar is quite dry. Not only in this, but also in other hydraulic works, Dr. Bruckmann rendered essential services to me, and therefore it affords me real pleasure to give him the present testimonial.—Nieder-Stotzingen, in the Kingdom of Wirtemberg, and the bailiwick of Ulm, the 12th of September, 1854.

(L.S.) "COUNT OF MALDEGHEM."

[*] It is very desirable to pierce the tube in question *after* the disclosure of the absorbent stratum or cleft, and never before or during its progress, for it may be necessary in the course of the boring to lower and prolong it further.

[†] It is a matter of course that my considerations relate only to fluids; as for solid substances, I refer, for the present, to M. A. Chevallier's account, quoted in the first division of this paper.

I have been astonished to learn, since my arrival in England, what an amount of activity, skill, and means, have been already expended for draining purposes, to which I found references in Mr. Dempsey's very interesting "Rudimentary Treatises on the Drainage of Districts of Lands," and on the "Drainage and Sewage of Towns and Buildings." London: Weale, 1854.[*] In the *Manchester Examiner and Times* of Jan. 5, 1856, I find the following article:—

> "AGRICULTURAL DRAINAGE IN ENGLAND.
>
> "To understand clearly the advance made in underdraining .and the extent of work yet to be done, the whole country was divided, geologically,[†] into three great characteristic areas. First, the western and north-western or alpine district of primary and transition rocks. In this, the quantity of land permanently drained does not exceed 500,000 acres; so that 7,525.000 acres of wet land yet remain to be done, at an outlay of £35,000.000. Second, the middle district, including all the secondary strata, exclusive of and up to the lower margin of the chalk. In this, the quantity of land permanently drained may be about 415.000 acres, so that there still remains to be done about 10,000,000 acres, at an expense of £50.000,000. Third, the eastern and south-eastern districts, comprising the chalk of the upper secondary strata, the wealden, and the tertiary and the post-tertiary deposits overlying the chalk. In this, it may be assumed that 450,000 acres have been permanently drained, including the metropolis, leaving 4,000,000 acres still requiring draining, at a cost of at least £22.000,000. These sums, though apparently large, cannot be so regarded when compared with those expended on other national enterprises. By their means there would result an increase of food in the aggregate of at least 5,330,000 quarters of the several kinds of corn which constitute the country's produce. Many practical men spoke of the increase on drained land as one-fourth, but none laid it at less than four bushels per acre."

The *Journal of the Society of Arts, and of the Institutions in Union*, London, Vol. IV., No. 160, December 14 1855, contains a very valuable treatise "On the Progress and Results of the Under-Drainage of Land in Great Britain,"[*] by J. Bailey Denton; and the above paragraph, on "Agricultural Drainage in England," is, I am satisfied, a short abstract from it. To Mr. J. B. Denton's treatise an enumeration of the present literature on drainage is added, on pp. 54-56; and the discussion on his paper, begun in No. 160, and continued in No. 162 of the same volume, is of great interest, and so much the more as the "Keythorpe system" spoken of in it, and executed on Lord Berners' estate, suggests, though only on a small scale, the establishment of absorbing bored wells. Thus, we read in the first paragraph, on p. 56, the following words of Mr. Joshua Trimmer:—"The distinguishing character of that system of draining was, that it took advantage of subterranean furrows between the soil and the subsoil," &c. &c.

Since, as we see from the last-quoted article, so many great things are still to be done for the improvement of wet land by drainage, which would indeed lay claim to the full activity of a competent judge in this department; and since large sums are set aside for obtaining these important purposes in a perfect manner, would it not be worth while, first, carefully to have the districts in question examined, in order to have pointed out those places where *absorbing bored wells* might be successfully established, and where not; and then immediately to make actual experiments in the construction of borings, as was done by me in Stetten, and thus probably to save to the country at least some part of the immense sums above quoted. Would it not be worth while to proceed in the same manner in different towns, boroughs, and villages, where, perhaps, a few perforations to a trifling depth, when treated skilfully, and with all possible caution, would carry off a large quantity of noxious fluids, and thus in a cheap manner replace an expensive system of sewers, &c., miles in length; or, where it might be advisable, to propose certain combinations of the common method of drainage with the establishment of absorbing bored wells.

My plain opinion is, that in all cases in which nature presents to us opportunity of adaptation to practical purposes, we should gratefully accept her kind offer, and carefully find out how far it can be made useful, before we can unconditionally resort to complicated and expensive technical systems; and that we should, according to the results of such investigation, employ the one or the other, or a combination of the two systems.

Finally, I remark, that, according to my manifold experience, a geological and hydrographical examination can generally be finished in a few days; it depends entirely on the result of the latter whether it will be advisable to propose an actual boring in order to obtain certain useful results, or whether such a project must be abandoned. The first and most important problem is always to find out when, and when not, the nature of the ground and the position of the place in question will enable us to carry out the desired intentions, and thus I believe that I can be of use in a twofold way:—

1. Under favourable circumstances, to advise and superintend the establishment of actual and successful works.

2. Under unfavourable circumstances, to dissuade from the construction of actual works, and thus to save sums which might be wasted for want of a careful survey beforehand.

These were the principles on which I operated in my practice on the Continent, during many years, and with satisfaction to my employers, as may be seen from the contents of my published works.

In conclusion, I may be permitted to quote a few lines from Alexander von Humboldt's "Comos," vol. I., p. 69:—

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[*] "Rudimentary Treatise on the Drainage of Towns and Buildings; suggestive of sanatory regulations conducive to the health of an increasing population." By G. Drysdale Dempsey, C.E., author of "The Practical Railway Engineer," and of the "Rudimentary Treatise on the Drainage of Districts and Lands." Second edition, revised and greatly extended.

[†] The geological maps, of which several have been published in England, give a good view of the formations of Great Britain. In the first note, on p. 611 of this journal, I have already pointed out the very good geological map of England and Wales arranged by Sir Roderick Impey Murchison. Others, and larger, are:—1. Geological Map of the British Isles and adjacent coast of France, constructed from published documents, communications of eminent geologists and personal investigation By John Phillips, F.R.S. and G.S., and engraved by J. W.. Lowry; published under the direction of the Committee of General Literature and Education, appointed by the Society for Promoting Christian Knowledge. 2. Geological Map of the British Isles and part of France, showing also the inland navigation by means of rivers and canals, the railways and principal roads, and sites of the minerals. I. A. Knipe, London, second edition, 1856. (Mr. Knipe's smaller map has the title—Geological and Mineralogical Map of England and Wales, with parts of Scotland, Ireland, France, &c.) Besides, I may be permitted to refer unprofessional men to the useful book—"A Rudimentary Treatise on Geology, for the use of beginners. By Lieut.-Colonel Portlock, R.E., F.R.S., M.R.I.A., &c. Third edition. London: John Weale, 1854;" and to "Reynold's Popular Atlas of Geology, illustrating and describing the principles of the Science. Revised by J. Morris, F.G.S."

[*] Bell and Daldy, 186, Fleet-street.

"Science only begins where mind takes possession of matter, where we strive to subject the multitude of ascertained facts to a knowledge based on reason; it is the intellect applied to nature."

ON MERCANTILE STEAM TRANSPORT ECONOMY.

A Paper read by Charles Atherton, Chief Engineer of Her Majesty's Dockyard, Woolwich, at a Meeting of the British Association, held at Cheltenham, in August, 1856.

The construction of ships and the administration of shipping affairs, involving a multiplicity of considerations of a scientific and of a practical and mercantile character connected with these arts, requires that shipping direction be regarded and treated as the subject of an exclusive science; and, of late years, the progressively extended application of steam to maritime purposes, and the prospect of its general use as an auxiliary power, have still further complicated the subject, and extended the range of mechanical acquirement which is now necessary in the prosecution of steam-ship equipment, direction, and management. It is, therefore, with diffidence, and with the feeling of my not possessing the combination of qualifications which is necessary to ensure adequate justice being done in all respects to the elucidation of the important subject, "Steam Transport Economy," that I enter upon the task of bringing that subject before the notice of the British Association for the Promotion of Science. I am, however, encouraged by the assuring reflection that public utility is a field in which it is an honour to labour, that lenient consideration for individual deficiencies and the helping hand of others will be extended to the most humble delvers in that field, and that credit may be earned in proportion to the roughness and obdurate nature of the spot of ground which we may have undertaken to break up, and to the perseverance by which one may at least attempt the accomplishment of the assigned task. Permit me, therefore, to remark that my present appeal to the British Association is but a continuation of my previous efforts in the cause of steam exposition, with a view to bringing "Steam Transport Economy" within the pale of arithmetical calculation; and as I shall have occasion to refer to the enunciation of principles and to the details of calculations which have thus preceded this essay, it may be convenient that I briefly enumerate the various published statements thus referred to as forming an integral portion of this paper, and which, accordingly, I beg to hand in to the Association for the purposes of reference and record.

1st. A brief essay on "Marine Engine Construction and Classification," published by Weale, in 1851.

The object of this essay was to analyse the data afforded by published and authentic statements of the actual test-trial performances of various steam-ships, and ascertain, by means of such comparative analysis, what are the peculiarities or proportions of build, and what are the peculiarities of engine-construction of those vessels which have attained to the highest degrees of locomotive efficiency, thereby also scrutinising how far the popularly received notions in regard to steam-ship type and marine engine construction, supposed to be most conducive to locomotive efficiency, may be in accordance with, or in opposition to, the results of actual experience, when measured by any definite and received law.

2nd. An essay on "Steam-ship Capability," originally published in 1853, and of which a second edition, with supplement, was published by Weale, in 1854.

This essay was designed to demonstrate the mutual relations which subsist between displacement, power, and speed in steam-ships; especially as respects the increasing scale of engine-power by which progressive increase of speed is attained; and to show the difficulties which attend the prosecution of a steam service in which long passages are required to be performed at a high rate of speed; also to show the sacrifice which attends the employment of vessels of an inferior type of build, as compared with vessels of a superior type. The supplement published with the second edition of this essay extended the tabular calculations to embrace vessels of hypothetical magnitude, and to demonstrate a system of £ s. d. arithmetical calculation applicable to estimating the cost of goods conveyance per ton weight by steam-ships, based on the constructive type of the ship, the speed to be realised, and the size of ship employed to do the work. The appendix to this essay embraces a dissertation on the probable capabilities of ships of unprecedented magnitude, showing the advantage of magnitude so far as mechanical principles are concerned irrespective of mercantile considerations, and under what combinations of speed and distance without re-coaling, comparatively with the more frequent coaling depots available to smaller vessels, the mechanical advantage of magnitude becomes neutralised; also giving new tables for facilitating steam-ship calculations, by showing the cubes of numbers from 5 to 25, rising by the decimal ·01, and the cube-roots of the squares of all numbers likely to be embraced in the tonnage displacement of ships.

3rd. A paper on "Steam Ship Capability," read before the Society of Arts, London, 16th May, 1855.

The object of this paper was to expose the indefinite nature of the terms "horse-power" and "tonnage" as respects their not being what they are generally supposed to be, definite units of measurement of engine-power and ships' size, also to show the uselessness for scientific purposes of all statistical data based on nominal horse-power and nominal tonnage, and the fallacy of all calculations based on those indefinite terms, thence showing the necessity for some definite measure of power being legalised as the unit of power to be denoted by the term "Marine Horse-power," and used as the base of calculation and contract engagement in steam shipping affairs.

4th. A paper on "Tonnage Registration" read before the Society of Arts, London, January 16, 1856, with the discussions thereon.

The object of this paper was to show the insufficiency for scientific purposes of the system of Tonnage Registration now in force as prescribed by the Merchant Shipping Bill of 1854, in so far that under this Act the registered tonnage of a ship affords no certain indication of the tons weight of cargo that the ship will carry, nor does it give, even approximately, the displacement with reference to any given draught, nor does the registration afford any indication of the power capable of being worked up to by the engines of steam ships, or any other data whereby the dynamic properties or locomotive duty of vessels may be scrutinised on scientific principles. In this paper, I brought forward certain suggestions for public consideration and discussion with a view to our official registration of shipping being rendered more comprehensive for the fulfilment of the various useful purposes to which statistical registration if complete would undoubtedly conduce, in a scientific point of view, irrespectively of merely fiscal objects.

These papers, of 16th May 1855, and 16th of January 1856, urging the establishment and recognition of definite units as the legal admeasurement of marine engine-power and ships' tonnage, I beg respectively to submit to the notice of the Committee appointed by this Association for the consideration of the tonnage question, of which Committee I had the honour of being named a Member, but I was under the necessity of declining to take part on this Committee in consequence of my being, as above stated, committed to certain views and publicly engaged in agitating the question of Tonnage Registration amendment, with a view to supplying the deficiencies of the present system.

Having thus shown that various investigations essentially connected with the elucidation of the subject now before us, "Steam Transport Economy," have constantly and publicly engaged my attention since 1851, I may now in the beginning of my paper announce the proposition to which I hope to direct the attention of the British Association.

Now, what I have undertaken to demonstrate is this: that, in consequence of there being no *legalised* definitions of the terms POWER and TONNAGE as standard units of quantity applied to the prosecution of steam navigation, there is practically no *definite* measure of quantity whatever attached to those terms, even although they are so generally made use of as the base of pecuniary contracts, and that, in addition to the private evils as between buyer and seller resulting from this singular anomaly in matters of mercantile account, the public evils, resulting from nominal "horse-power" and "tonnage" being terms which cannot be scientifically recognised as expressing either the working power of marine machinery or the size of a ship, are monstrous, inasmuch as they publicly defeat science from being brought to bear on steam ship construction and steam ship management as a means of investigation and proof whereby to confirm the existence and establish the continued adoption of good practice where good practice does exist, and to detect error either in the construction of steamers or in the management of steamers in cases where bad types of construction and maladministration may exist and be destructive of enterprise which might otherwise have conduced to public good. In short, my object is to show that in consequence of the deficienices in our national standard units of power and tonnage, and deficiencies of our statistical registration, the public are deprived of the benefits capable of being derived from science as a means of discriminating between good and bad practice in the great matter of shipping, thus enabling us to take advantage of the one and explode the other. The constructive merits of steam ships in a dynamic point of view may be comparatively determined by the ratio that subsists between the amount of displacement that is propelled from place to place, the speed or time in which the vessel performs the given passage, and the engine-power exerted or the coal consumed in the performance of the work; yet every ship that is launched and goes with flying colours upon the usual test-trial, is always for the day pronounced to be the most wonderful ship that ever was built, and no wonder that it is so, considering that the dynamic merits of ships are thus determined, not by any admitted rule based on the mutual relations of displacement, power, and speed, but by acclamation based on the mutual interests of all concerned, that a new ship shall be of good repute. All attempts to expose this monstrous deficiency in our nautical system by urging the importance of statistical registration, have been held up to reprobation as an interference with the shipping interests, regardless of the fact that it is the public who pay the penalty of an enhanced price of goods transport consequent on whatever deficiencies may exist in connection with the locomotive properties of our shipping.

In justification of these remarks as to our denominations of ships' tonnage and engine-power being a delusion, subversive of all truth so far as scientific inquiry and research may be based thereon, I may be permitted to adduce the following statements:—

1st. As to tonnage registration. Although tonnage measurement for registration has been subjected to legislative revision under the Merchant Shipping Act of 1854, the term "tonnage" is still made use of in various significations. By the present law, 100 cubic feet of internal roomage, or available space for cargo, constitutes the unit of tonnage, but as respects all ships built previously to the month of May, 1855, when this Act came into operation, the adoption of this law is not compulsory. Merchants have the privilege of retaining the former registration of some ships, and getting such others of their ships measured and registered under the new Act as they may think fit to select for re-registry, so that the term tonnage may now signify "builders' tonnage," old measure, under the Act of 1773, or tonnage under the Act of 1833, or tonnage under the Act of 1854, and these are three totally different systems of admeasurement, having no definite ratio to each other. Moreover, the unit of tonnage under the Act of 1854 being based on internal roomage *measuring up to the deck*, affords no certain indication of the displacement of a ship when loaded fit for sea, nor does it afford any assurance whatever as to the tons weight of cargo that a ship will carry, for example, by adopting the cellular principle of build now introduced in the construction of iron ships, a ship of 10,000 cubic feet of internal roomage, or 100 tons register tonnage, may have such external displacement as would safely float with the whole internal roomage filled with iron, and therefore weighing no less than 1,000 tons of dead weight, or ten times the register tonnage, and the registration of steam-ships is open to similar delusion as to their capability for weight of cargo. So much for the mercantile liberties that may possibly be introduced, and taken with our statistics of exports and imports so far as they may be based on the tonnage registration of shipping under the Act of 1854.

The abortiveness for statistical and scientific purposes which has hitherto attended all legislation on tonnage registration, appears to have been occasioned by the attempt to embrace under the one term, "Tonnage," two things which have no fixed ratio to each other, namely, tonnage by bulk, and tonnage by weight. The law has not comprehended the double mercantile use and application of the term "ton" by providing for the separate and distinct registration of each, namely, tonnage by bulk and tonnage by weight, the capability of ships for bulk tonnage being dependent on internal roomage, but the capability of ships for weight tonnage being dependent on external displacement, a distinction which is not noticed by the new law of tonnage admeasurement under the Act of 1854.

2nd. As to marine engine-power. Although Watt originally defined the unit of power, which he denominated horse-power, as equivalent to 33,000lbs. weight raised one foot high in one minute of time, and invented a mechanical device or instrument called a "steam indicator," whereby the variable pressure of the steam in the cylinder and consequently the working power of steam-engines could be readily ascertained (whence the working power so ascertained was denominated the "*indicated* horse-power"), all which arrangements of Watt put the working operation of the steam-engine originally on a scientific base, defined by a standard unit of power admeasurement, still this definite unit of power was never recognised by law, and consequently the steam-engine was no sooner applied to maritime purposes, than the rivalry of trade induced a practice under which the nominal, or contract power of engines, did not specifically regulate the working capability of the engine delivered. Engines were not objected to by the purchaser if their working capabilities were in excess of the nominal power, and engineers themselves voluntarily supplied marine engines working up to an "*indicated*" power far in excess of the "*nominal*" power, for the purpose of thereby driving the new vessel at a higher rate of speed than that attained by some rival vessel with the same nominal power. Reputation for the production of fast steamers depended on beating the rival boat, not on the mode of effecting that object. The shipping interests and their working craftsmen, shipwrights and engineers, felt themselves constrained to meet their rivals in trade with their rivals' weapons; numerous devices have been adopted with a view to the development of power on board ship by packing the greatest amount of engine-power into the least space, and undoubtedly great improvements have been made by adapting the dimensions and proportions of vessels to the service required, but still "Fame," in regard to the character of steam ships based on speed, has been too much the result of horse-power delusive jockeyship rather than of truthful science. By the practice of trade, horse-power came to be measured by the diameter of the cylinder, without any limitation as to the capabilities of the boiler, and gradually in time a marine-engine contract was considered not to be fulfilled unless the engines were capable of working up to an "indicated horse-power" at least double that of the contract nominal power; still, however, no specific limit was assigned either by custom or by law, and, at length, to such a degree has competition set truth at defiance, that the working, or "indicated horse-power" of engines delivered under contract has frequently amounted to four times the nominal horse-power actually stipulated for by the contract. These facts are fully set forth in the paper read by me before the Society of Arts on the 16th May, 1855.

Having thus pointed out the indefinite application in steam shipping practice of the terms "tonnage" and "horse-power" with reference to the definite terms "displacement" and "indicated horse-power," it may be still further edifying that we illustrate the anomalies liable to result when these terms are used in combination with each other, as is constantly the case in expressing and recording the ratio of tonnage to power of a steam-ship. In exposition of this matter, I may again refer to the before-mentioned paper, whereby it will be seen that I selected ten vessels, in each of which the ratio of builders' tonnage to nominal power was very nearly the same, namely, in the ratio of 100 tons of builders' tonnage to 40 nominal horse-power, or 2½ tons of tonnage to one nominal horse-power; but on comparing the constructors' load displacement of these same ships, calculated in tons weight at 35 cubic feet of water to the ton, with the *effective* working power, based on indicator measurement, the ratio was found to be 100 tons displacement to 38 horse-power in one case, and 100 tons displacement to 281 horse-power in another.

The recorded statistics of these ten vessels would lead one to infer that they are all powered in the same proportion of engine-power to size of ship; but, in fact, they are all different, and on comparing the two extremes, one ship has no less than seven times the power of the other, in proportion to size of ship as determined by displacement. In fact, generally, the records of register-tonnage and nominal horse-power do not constitute statistical data of any value whatever for the scientific purpose of discriminating between the relative dynamic merits of steam-ships, but, on the contrary, such records and all ideas resulting therefrom are positively delusive and mischievous. The conclusion at which I would arrive from these statements is, that the very first step in any attempts to bring steam affairs within the range of arithmetical calculation must necessarily be to establish the measure or value which we assign to our units of tonnage and power. It is only by the moral influence of such a body as the British Association that the cause of science can obtain a hearing in this matter of statistical registration applied to shipping. With reference to our units, it is, of course, desirable that the measure of the unit, to be legally recognised as the unit of power, should be nearly in accordance with the general average of practice at the time when the unit may be so established; and as at the present time (1856) the general run of marine nominal horse-power varies from two indicated horse-power to four indicated horse-power, that is, from 66,000 lbs. to 132,000 lbs. raised one foot high per minute, it is submitted that the unit of marine horse-power would now be most conveniently fixed at 100,000 lbs raised one foot high per minute. Until, however, some definite measure of the unit be legally recognised it is considered advisable in matters of scientific inquiry like the present to adhere to the measure of the unit originally proposed by Watt, namely, 33,000 lbs. raised one foot high per minute, designating this scale of measurement as the "indicated horse-power," thus:—Ind. h. p.; and such will be the unit referred to when horse-power is spoken of in the following pages of this paper.

Now, as to the measure of the unit of tonnage by which the sizes of ships are to be spoken of and compared, we have already observed that under the Merchant Shipping Act passed in the year 1854, the unit of tonnage is based on the internal roomage of ships available for cargo; that all ships built since May, 1855, are registered under this Act; but the re-measurement and re-registration of ships built previously to 1855 is not made compulsory. Shipowners have the privilege of re-registering, under the Act of 1854, such vessels as they may select for that purpose; consequently, our present registration is mixed, and the various units of tonnage-measurement thus embraced under our present tonnage-registration have no definite ratio to each other, or to the tons weight of cargo that ships will carry. The comparative merits or demerits of these various systems of registration for *fiscal* purposes need not be here discussed. Suffice it to say that in none of these systems has any notice whatever been taken of the measurements which constitute displacement; and as displacement is an essential element in any scientific investigation as to the locomotive performance of steam-ships with reference to the power employed and speed attained, it follows that our present registration of shipping, even under the Act of 1854, does not afford statistical data of such a character as to be available for science in the matter of comparing the merits, in a locomotive or dynamic point of view, of the various models or types of form by which steam-ships have been constructed. It is submitted for the consideration of the British Association that national advancement in maritime affairs, especially in regard to transport economy, would be promoted by our public registration of shipping in general, and of steam shipping in particular, being so systematized as to embrace not only the roomage measurement required for fiscal purposes, but also, in addition, those details of *displacement* which in combination with the data of speed and power derived from the actual performances of ships, are necessary to scientific investigation in determining the relative dynamic merits of different types of form of steam-ships. It must be borne in mind that it is the Public, the consumers of merchandise, who must ultimately bear all the expenses connected with the transport and delivery of merchandise, whether well or ill performed. Bad ships individually enhance the average cost of imported corn and all other consumable merchandise. Bad ships also enhance the price of cotton and all other similar raw material imported for the production of export manufactures. This enhanced price restricts demand, thus curtailing the sources of employment, so that every bad ship, whether employed in the import or export trade is, of itself, a public nuisance, a prevalent bad type of ships would be a public calamity, and progressive improvement would be a public benefit. It has been said that the interests of shipowners is in itself a sufficient guarantee for insuring the adoption of the type of ships best adapted for mercantile steam-transport economy. It is scarcely fair to base any argument on interested motives, but as that argument has been raised it must be noticed. Undoubtedly, each shipowner has an individual interest in his own ships being the best afloat, but if he does possess the best ships, it is equally his interest to keep that fact and the means of acquiring them to himself, so that the charges for freight may continue to be ruled by the inferior dynamic qualities of the average ships employed by the trade, not by the superior dynamic qualities of the best ships as possessed by himself, the difference being the shipowner's private advantage or the public's loss. It is, therefore, the interest of the public that all bad types of shipping be exposed and eradicated. Freight would then, as respects the quality of ships, be ruled by a scale of charges derived from the performance of a generally improved type of ships working in fair competition with each other.

(*To be continued.*)

ART TREASURES EXHIBITION.

A proposition has been made to the Executive Committee of this Exhibition, by Messrs. Fenton and Delamotte, to take a series of photographs of the most remarkable objects which will there be collected, so as to form a permanent memorial of the event. The series would naturally comprise photographs of the building itself, both in progress and in a complete state, and of selected specimens from the pictures, both ancient and modern, of the sculpture in wood, marble, ivory, bronze, terra cotta, &c., and of the decorative furniture, tapestry, goldsmiths' work, glass, and pottery. Such a series would not only form a permanent memorial of the Exhibition, but, by the facility with which copies can be multiplied, would tend greatly to increase the general knowledge of art, and elevate the national standard of taste. A complete collection might be formed as a permanent Art Exhibition for the Museum in Manchester, thus affording a source of continual instruction to the working men of that place. If such an undertaking be determined upon, no time should be lost in commencing the work, and no doubt the owners of works of art would readily grant facilities for its execution.

ANTHRACITE DOMESTIC FIRES.

An American correspondent, now a resident in England, in reply to a letter from the Secretary, writes as follows:—

"With regard to the open principle of burning anthracite, to which you allude in the latter part of your letter, I am happy to say that I am quite familiar with it, as I never used any other than anthracite coal in America. There are peculiarities about it, both in the construction of the grates, and in the mode of making the fire. The bars of the grates must be made upright, and their cross-section should be an isoceles triangle, with the open side next the fire. The bars should be about an inch and a quarter apart, and should be uninterrupted by cross-bars in their whole length. Instead of a large open space above the fire, as used here, the jambs should be no further apart than the width of the grate, and the throat of the chimney should be narrow. You will see that all these provisions have for their object to obtain a fierce draught, without which anthracite cannot be successfully burnt. Added to all, is a *blower*, which covers the whole of the fire-place down to the bottom line of the grate. This is only used when the fire is kindled, and when fresh fuel is applied, which latter operation need only be performed once or twice in the course of the day. The kindling is an operation in which a novice would be very apt to fail. In America, charcoal is generally used for the purpose, because it is so cheap, and burns so freely; but wood or bituminous coal would answer. The anthracite should be added gradually, until a considerable quantity of it has become ignited. When it once begins to burn, the whole difficulty is over, and it is quite common with us to keep a fire in all the winter, night and day. The fire once made, burns brightly five or six hours without attention, and gives a great heat. If the air be found too dry, an open pan of water will remedy the evil. To renew the fire, fresh coal is put on, the ash is removed by the poker, and the blower applied for a miuute or two.

"You ask whether the system answers? I can only say that it is universal in America, and that we keep very comfortable through long winters, with the thermometer constantly in the neighbourhood of zero, almost as often below as above it. As a mere matter of taste, I prefer bituminous coal, on account of the cheerful blaze, but it is much more troublesome, and very destructive to all beautiful objects that may be in the room where it is burning. Anthracite, on the contrary, gives no smoke, no blacks, only a fine dry dust, that is easily removed. Hence, it does no injury to fine furniture or works of art, and gives the housewife some encouragement to neatness and elegance in every part of her establishment, as it is not condemned, as here, to eternal, inevitable dinginess.

"I am not aware that there is an anthracite fire-place to be seen here. It would cost very little to try the experiment, and I should be happy to aid in it to the best of my ability. If the Society felt disposed to have such a grate put up, I will furnish the necessary drawings and instructions, and superintend the trial, if you desire it.

"With regard to the pecuniary question, anthracite is the most economical fuel by far, when the two descriptions of coal are at the same price per ton. That is usually the case with us, but the bituminous coal is comparatively little used for domestic purposes."

NEW PROCESS OF STEREOTYPING.

A new and simple method of stereotyping has just been patented by Mr. Hogg, of Edinburgh. The process consists of a mixture of various ingredients, finely pulverised, and mixed up to the consistency of putty. In this state the substance is spread with a knife on a piece of wrapping paper, and then passed under an accurately adjusted straight-edge, by which means a surface as smooth and equal as a sheet of paper is obtained. The material for the matrix being thus formed, it is laid on the types, the composition, in a soft state, being next the face. An impression is then taken by the common printing press, but the pressure required is so slight, that Mr. Hogg uses an ordinary copying press for the purpose. The matrix, affixed to the face of the types, is then laid on a gently heated hot-plate for about twenty minutes, after which it is ready for being cast from. From the impression being taken as in the ordinary mode of printing, a perfectly level surface on the face of the stereotype plate is attained. There is no shrinking or twisting of the matrix, as in casting from stucco. No more damage is done to the types than by pulling a proof at the hand-press; what printers will understand as low spaces and leads are preferred; there is no filling up of the types with the material of which the matrix is made. Little of what is understood as "picking" of the plates is required, while the saving to the printer in the wear of types is very great. This process admits of the metal being used at any temperature.

Home Correspondence.

A NEW MANURE.

SIR,—The new manure, the experiments on which are detailed below, is a waste product, which arises in the purification of gas by my process patented two years ago. In this process, common clay is used as an auxiliary to lime in the purification of gas. The clay absorbs and retains, in the form of true chemical compounds, substances over which lime has no power; which are most detrimental in gas, but of great practical value as manure. The clay, when spent as a purifying agent, contains ready-formed ammonia in considerable quantity, part of which exists in volatile, but the larger part in non-volatile, salts.

It contains also much nitrogen, variously combined with other substances, which, by eventual decomposition in the soil, will form carbonate and sulphate of ammonia. This portion of nitrogen becomes active only after some time, and, therefore, the crops thus manured are sustain their later periods of growth as well as *stimulated* in their infancy.

It also contains a quantity of sulphur, carbon, and phosphorus, in forms of combination which experience has shown are valuable as plant-food, but the description of which would involve too much technical chemistry to render it suitable in a popular account intended for general perusal.

The clay employed for purification is such as is commonly used for brickmaking. This is pulverised and slightly moistened before being placed in ordinary dry-lime purifiers. When saturated it is removed thence, a black fœtid mass, loaded with impurity.

Exposure to the atmosphere oxidizes some of the absorbed substances, and the clay may be used a second time with advantage, when the object is to *manufacture manure* as well as purify gas. The saturated clay needs nothing but laying a short time under a shed to dry, before it is made fine, like guano, and applied to the land.

Present experience shows that a ton per acre is an adequate, and a ton and a half per acre a maximum, dressing for grass land; a ton per acre is the maximum quantity for arable land, and when so much as this is put on, it should be ploughed down and not suffered to come into contact with the seed. Half-a-ton mixed with the manure has operated most beneficially upon potatoes, and will probably do so upon turnips. It has not been thus tried, but used alone broadcast it has grown capital turnips.

The *cost* of producing this manure is comparatively trifling, and when sold at 5s. per ton it leaves a handsome profit to the company producing it.

The *quantity* capable of being made is enormous, and daily increasing. One single London Gas Company is probably able to produce upwards of 40,000 tons per annum. The gas companies in the United Kingdom number, I believe, about a thousand, and obviously could supply almost any demand.

Elijah Smith, gardener to the Wakefield Union Workhouse, tried a load of the new manure from the Wakefield Gas Works in 1854. He applied it alone to:—1, early turnips; 2, onions; 3, broccoli; 4, cabbage.

1. The turnips were particularly fine, having tops upwards of two feet six inches high, with leaves broader than a man's hand.

2. Onions killed by excess of manure.

3. Broccoli became, a short time after planting, as blue as if painted, but still the plants grew freely. Gradually the blue changed to a dark luxuriant green, and the quarter was the admiration of all who saw it. The severe winter of 1854-5 killed much of this broccoli, as it did all in the neighbourhood. What was alive was considerably hurt, but as spring advanced it became luxuriant, and produced as fine heads as could have been obtained by any manuring whatever.

4. Cabbage, planted very late and bad plants. Looked badly all the winter of 1854-5, but when the growing season commenced in spring it looked quite as well as a neighbouring quarter well manured with stable dung, and hearted as well, though about three weeks later.

Soil a hungry sandy loam upon poor sandstone gravel.

John Turner, farmer, Stanley, used a single part of a load (from Wakefield Gas Works) upon grass applied early in January, 1855. Patches of grass were killed where the manure was put on too thickly, but all around the dead spot the grass grew in the most beautiful manner. On the 1st of May, 1855, the grass on the manured spots was 6½ inches high, while, owing to the dry weather, the rest of the field was bare. The enormous difference of colour and crop was visible to every one. Patches of the finest green Genoa velvet upon an old brown frieze coat, is no inapt picture of the difference. At mowing time there was more than three times the quantity of grass where this manure was put than there was in other parts of the field.

Encouraged by this result he dressed the whole of a 9½ acre field, in 1856, save three lands in the middle, which were manured with "short muck." Remarked all through the spring the beautifully dark green colour of the dressed portion, and that where most of the manure was put the grass looked best. The field is now open to inspection, and in the third week in June, where the new manure was properly put on the grass measured on an average maximum 42½ inches, minimum 27 inches. The part not dressed with this manure was maximum 24½ inches, minimum 14 inches. Soil here a strong cold undrained clay, in many parts wet.[*]

John Thompson, farmer and assistant-overseer, Outwood, near Wakefield, obtained two small loads from the Wakefield Gas Works, and mixed it with about an equal amount of soil. This was applied to about two acres of grass. Against it were used:—1, farm-yard manure mixed with soil; 2, lime and soil compost. In this instance the colour has been throughout better with the new manure. It continues to have the same marked difference in colour; it is thicker in the bottom, and very much stronger than either of the other plots against which it was tested. I visited this field in company with a friend, and we were both struck with the great superiority of the grass grown with the new tillage.[†]

I have made several experiments with it myself. In October, 1854, I applied about a ton to half an acre of land, for cabbage. The severe winter killed a considerable portion of the crop. Windsor beans were, therefore, planted among part of the cabbage in the spring of 1855. These produced largely, and the cabbage which was not killed did well. Another part of the cabbage-crop was destroyed, and the ground planted with long red mangold wurzel in April, 1855. The extremely dry season rendered root crops in the neighbourhood very deficient, but notwithstanding the drought, this mangold looked well and grew freely, and when topped and tailed, and weighed at the public weighing machine, was found 24 tons 4 cwt. per acre.

A crop of white wheat is now growing upon this half-acre, and could not look better. The leaf is broad and almost black green. The straw is particularly strong, and all who have seen it pronounce it the best wheat they have seen this year.

Besides this, an acre of the same kind of white wheat is growing in the same field. This was sown after potatoes, manured with part of the heap mentioned in my essay on the Fermentation of Manure, in the *Journal of the Royal Agricultural Society*, pp. 11-12, experiment 5, and in note p. 12, experiment 2. This crop is very fine, but the former is decidedly superior in three respects. 1. The increased darkness of colour, owing to the more highly-nitrogenised manure. 2. The broader leaf. 3. Stronger straw, due to the soluble silicates in the manure when applied, and also, I think to the silica rendered, soluble by the ammonia produced (in the presence of silicates) from the nitrogen which exists in the clay. principally in combination with carbon and sulphur Perhaps I ought to add, 4thly, the rather shorter straw, which renders the crop less liable to lodge. The potato wheat averages 40½ inches in height; and that grown with the new manure, 37½. Seed, two bushels per acre, sown broadcast and ploughed down. Since sowing-time, *nothing whatever* has been done to either crop, that no disturbing element from culture might vitiate the comparison.

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[*] The hay from this field is stacked, and fully realises the promise it gave before being mown. An examination of the field since it was mown shows that the crop might have been improved by more careful spreading of the manure, as in some places too much has been put on, and in others too little. The after grass grows very rapidly, and the field will pay well for mowing again, if the weather be fine to get the second crop. This is certainly striking, as the field had not been manured for four or five years, and yet had been mown annually, and the cost of manure per acre this year was less than 7s. 6d.

[†] This crop is mown and carried, and Mr. Thompson informs me that the grass on the portion manured with the new manure was double that upon either of the other portions. Here the cost was 5s. per acre with this fertiliser, while the farmyard dung cost 30s., and the lime compost not very much less.

A very instructive though unintentional experiment was made in this field. The load of manure from the gas-works was shot up and allowed to remain in a heap for a few days, owing to wet. When spread, it was carefully shovelled up, and nothing was supposed to be left. On this area nearly every plant of wheat died as soon as it sprung up; and the few plants which were not killed are so dwarfed and injured by the excess of manurial substance, that it is doubtful whether they will ever bear anything. *But around the margin* of the heap, where a relative excess of manure was scattered, but where there was no drainage from it, the crop is extremely luxuriant. Oct., 1854.—This manure was applied at the rate of more than 5 tons per acre to a piece of land containing about 300 square yards. Every crop sown or planted on this land was killed, or so stunted as to be worthless, till some cabbages were planted in 1855, which have stood the winter, and are extremely dark in colour, but smaller than others of the same kind growing on adjacent land manured in the ordinary manner. Potatoes, interlined between cabbage, grow freely, and are very dark in colour. The known excess purposely applied in this case is only just beginning to expend itself sufficiently to do good instead of harm.

A ton of the manure was mixed with a manure heap, and applied to three acres of potatoes planted this spring. Planting began April 22nd, and finished May 5th. Part of the sets were sprouted, and set with the spade. The rest were set by the plough in the usual manner. All grow fast, and look well. Unless dry weather comes soon, those which were sprouted will produce too much top.*

In the spring of 1855, a plot of bad grass, which I know had not been manured for ten years, was freely dressed with this manure. The dressing was as large as can be safely given. This plot was mowed *five times* by a man in the neighbourhood, to whom the grass was given for his horse. Each time the swathe was close and heavy; while, on an unmanured portion adjoining, the grass would hardly stand against the scythe. At one mowing, when about a foot high, the grass was beginning to rot at the bottom, owing to its thickness. This is a particularly favourable result, when the extreme dryness of 1855 is remembered.

I am, &c.,

W. R. BOWDITCH.

P.S. I am informed that Mr. Pepper used it with the best results, but I did not see his grass.

NEGATIVE OR ABSORBENT ARTESIAN WELLS.

SIR,—In reference to the description of absorbent artesian wells in this country, or negative artesian wells, as Dr. Bruckmann proposes to new name them, I beg to call his attention to an article by me in the *Civil Engineer and Architects' Journal*, Vol. III., p. 118, for April, 1840, in which the system, as adopted in France, is fully described, with suggestions for its application in Hackney, Lambeth, and Woolwich.

I am, &c.,

HYDE CLARKE.

42, Basinghall-street,
9th August, 1856.

Proceedings of Institutions.

HALIFAX.—The new building of the Mechanics' Institute is now nearly completed. It contains a large assembly room, able to accommodate 700 persons; in addition to which there is a library and reading-room, and twelve class rooms, besides a large one, intended for a class in drawing and design. The estimated cost of the building is stated to be £8,000, towards which about £3,400 have been already subscribed. The number of members is at present about 500, and in the classes, which are fourteen in number, about 200 male and 60 female pupils are instructed. The hall will probably be opened at the latter end of October.

To Correspondents.

ERRATA.—In the last number of the *Journal*, p. 633, col. 2, note, line 1, for "Brunnenstaben,"read "Brunnenstuben;" line 4, for "Ueber Arlegung," read "Ueber Anlegung;" line 6, for "Breisganes," read "Breisganes;" line 7, for "Fromberg." read "Fromherz;" p. 634, col. 1, line 17, for "Brunnenstaben," read "Brunnenstuben;" notes, line 3, for "Auerstedt," read "Qnenstedt;" line 21, for "Zahrbücher," read "Jahrbücher;" p. 636, col. 1, notes, line 7, for "Auellen," read "Quellen;" line 9, for "Perisdicität," read "Periodicität;" and for "Auellen," read "Quellen;" col. 2, line 2, for "Buschelesteich," read "Büschelesteich; p. 637, col. 1, note, line 2, before "Fertigung," insert "zur;" p. 638, col. 1, note, line 19, for "obserwäbischen, read "oberschwäbischen."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August 8th*, 1856.]

Dated 16th July, 1856.

1669. John Bourne, 9, Billiter-street, City—An improved construction of paddle wheels, usually termed "feathering paddle wheels." (A communication.)

Dated 17th July, 1856.

1683. John Cartwright, Shrewsbury—Improvements in agricultural implements called "chain harrows," for more effectually dressing and cleaning land.

Dated 21st July, 1856.

1715. Elias Leak, Longton, Staffordshire—A thimble pillar, with points and branches, to be used in placing "glost" china and earthenware in ovens and kilns, when firing, burning, or baking such ware, in lieu of the cockspurs and stilts now in use for that purpose.
1717. Francis Barbour, Manchester—Improvements in pen-holders. (A communication.)
1719. James Clark, Newton Heath, Manchester—Improvements in the manufacture of waterproof fabrics.
1721. John Gedge, 4, Wellington-street South, Strand—Improvements in obtaining and applying motive power. (A communication.)
1723. Maurice Vergnes, New York, U.S.—Improvements in electro-galvanic machines for producing motion by galvanic electricity.
1725. John Edward Hodges, Leicester—Improvements in machinery for the manufacture of looped fabrics.
1727. Jacob Bing, Hamburgh—A new sauce boat, or vessel for containing liquids of different densities.

Dated 22nd July, 1856.

1729. Clothide Amet, Tavistock-street—Improved means of distending articles of dress and preserving the form or shape thereof. (A communication.)
1731. Elias Weisskopf, Pesth, Hungary—An artificial combustible, chiefly applicable to the kindling of fires.
1733. Sven Johan Agrell Burg, 1, Serle-street, Lincoln's-inn—Certain improved apparatus for preventing the explosion of steam boilers. (A communication.)
1735. Samuel Butcher, Bristol—Improvements in kitchen ranges.
1737. James Clark, Newton Heath, Manchester—Improvements in the manufacture of beds, mattresses, cushions, and seats.

Dated 23rd July, 1856.

1739. George North, 9, Ashburnham-road, Greenwich—An improved spring catch for the security of jewellery and articles of personal ornament and general utility.
1741. Ferdinand Potts, Birmingham—Certain improvements in tags for stay and other laces, as also in the machinery for forming and finishing the same.
1743. William Webster, 22, Bunhill-row—An improved steam and fire regulator. (A communication.)

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* These potatoes are by general consent admitted to be the best in the neighbourhood. The tubers answer to the luxuriance of the tops, and, if not injured by weather, they cannot fail to be a heavy crop.

1744. William Webster, 22, Bunhill-row—Improvements in pumps. (A communication.)

1745. Roger Bolam Ellison, 9, Brook-street, London-road, Carlisle—Improvements in electric telegraph apparatus.

1747. Alexander Bain, Brompton, and Bennett Johns Heywood, Leicester-square—Improved apparatus for supplying and drawing off liquids, and for stopping the flow of liquids and aeriform bodies.

1749. John Derbyshire, Longton Potteries, Staffordshire—Improvements in cocks, taps, and valves.

1751. Constantin Louis Detouche and Jean Jacques Emile Robert Houdin, junr., Paris—Improvements in the application of clocks or timekeepers, actuated by electricity, to street and other lamps.

Dated 24th July, 1856.

1753. Helmuth Carl Friedrich Martin Petschler, Manchester—Improvements in obtaining and applying motive power, and in the machinery or apparatus connected therewith.

1754. James Ashman, Swansea—Improvements in the manufacture of artificial limbs.

1755. Charles Burton, 162, Regent-street—Improvements in warming houses and other buildings.

1756. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—An improvement in the manufacture of driving straps or bands. (A communication.)

1757. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of flexible hose and tubes. (A communication.)

1758. George Collier and John Crossley, Halifax, and James William Crossley, Brighouse, Yorkshire—Improvements in finishing and stretching woven fabrics.

1759. George Alexander Copeland, Constantine, near Falmouth, Cornwall—An improved safety blasting cartridge, for the use of miners and quarrymen.

1760. Charles Tiot Judkins, 98, Fleet-street—An improved gas regulator.

1761. Joshua Mather and William Forshaw, Bolton-le-Moors—Certain improvements in pickers for looms and apparatus connected therewith.

1762. Richard Archibald Brooman, 166, Fleet-street—Improvements in grindstones. (A communication.)

1763. Charles François Cattaert, Paris—Improvements in the stoppering of inkstands, bottles, pots, jars, and other vessels, and closing cocks.

Dated 25th July, 1856.

1764. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in the manufacture of vulcanized india-rubber thread. (A communication.)

1766. Edward Lord, Thomas Lord, Abraham Lord, and William Lord, Todmorden—Improvements in machinery for opening, blowing, scutching, and preparing cotton and other fibrous substances.

1767. William Wood, Monkhill-house, Pontefract—Improvements in machinery or apparatus for weaving pile fabrics.

1768. Thomas Byford, Carlton-villas, 34, Edgware-road—Improvements in horses' bits.

1769. Robert Stewart, Glasgow—Improvements in cutting stone and other mineral substances.

1770. Thomas Wrigley, Bury—Certain improvements in machinery or apparatus for cleaning "cotton waste" or other materials used in the manufacture of paper.

1771. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in scutching machines. (A communication.)

1772. Samuel Jay and George Smith, 246, Regent-street—Improvements in stuffing or padding couches, cushions, bedding, chairs, and other similar articles.

1773. Ebenezer Howes, Liverpool—An improved construction of anchor. (A communication.)

1774. William Lanphier Anderson, Norwood, Surrey—Improvements in propellers.

1775. Isham Baggs, Manchester-street, Argyle-square—Improvements in apparatus for lighting, signalling, and telegraphing by means of electricity.

1776. Julien Denis, Queenhithe—Improvements in cutting or perforating steel and other metals. (A communication.)

Dated 26th July, 1856.

1777. Joseph Platt, Audlem—Improvements in door-knockers.

1778. Charles Hodges, Manchester—Improvements in apparatus for unwinding silk, thread, or yarn from the hank. (A communication.)

1779. Richard Clarke Pauling, Great George-street, Westminster—Improvements in giving increased buoyancy to ships and vessels, in raising sunken vessels, in keeping structures water-tight, and in propelling vessels.

1780. James Dickinson, Liverpool—Improvements in anchors, and in the manufacture of the same.

1781. Samuel Yeadon, Idle, near Bradford, and George Chapman, Stockport—Improvements in the construction of reeds for weaving, and in machinery or implements and materials to be used in such construction.

1782. George Colleton Cooke, George-yard, Lombard-street—Improvements in stereoscopes.

1783. Henry Remington, Camberwell—An improved gas heating and cooking apparatus.

Dated 28th July, 1856.

1787. Edmund Eaborn and Matthew Robinson, Clement-street, Birmingham—Certain improvements in machinery to be used for confectionery purposes.

1789. William Edward Newton, 66, Chancery-lane—Certain improvements in steam-engine governors. (A communication.)

Dated 29th July, 1856.

1791. William Griffin and Elizabeth Duley, Northampton—Improvements in studs and buttons for fastening articles of dress.

1793. John Knowles, Derby, and William Buxton, Brimington—Improvements in tuyères.

1795. Henry Richard Bowers, Penbedw, near Ruabon, Denbighshire—Improvements in machinery or apparatus for grinding, crushing, or pulverizing clay and other substances.

1797. Alexander Williams Anderson, Trinidad—Improvements in refining sugar.

WEEKLY LIST OF PATENTS SEALED.

Sealed August 8th, 1856.

343. John Elce and Samuel Fletcher Cottam.
356. Henry Bessemer.
361. Frederick Steiner.
365. William Frederick Collard Moutrie.
366. Samuel Fox.
367. Richard Knight.
372. Henry Fort Mitchell and Wm. Mitchell, and John Clarkson.
383. John Taylor.
389. George Gulliver and John Goldthorpe.
439. William Oliver Johnston and John Dixon.
457. Leonard Bower.
472. Samuel Rodgers Samuels.
485. John Barrow.
515. Pierre Louis Grosrenaud.
530. John Henry Johnson.
541. Julius Homan.
679. John Henry Johnson.
700. William Edward Newton.
1097. George Jordan Firmin.
1099. William Edward Wiley.
1113. Bartholomew Beniowski.
1116. Richard Whytock.
1122. Michael Hodge Simpson.
1124. Hiram Tucker.
1129. William Edward Newton.
1224. Charles Barreswil.
1243. Pierse Eustace Laurence Barron.
1254. William Hulse.
1257. Frederick Charles Jeune.
1279. Alexander Drew and Matthew Gray.
1339. John Norris, jun.
1390. James Eives.
1417. Charles Desnos.
1428. James Eives.
1437. Matthew Andrew Muir and James Mcllwham.
1450. William Radley.

Sealed August 12th, 1856.

362. Pierre Isidor David.
363. John Mills.
391. Edward Oldfield.
394. James Hogg, junr.
397. John Henry Johnson.
402. George Harrison.
455. William Vincent Wallace and Benjamin Lawrence Sowell.
467. Robert Baker Jones,
491. John Cornes.
493. Francis Thompson.
557. Samuel Last.
569. Richard Archibald Brooman.
579. Robert Hannah.
819. George Tomlinson Bousfield.
1087. Alexander Charles Louis Devaux.
1099. William Basford.
1267. William Edward Newton.
1275. George Bell and George Charles Grimes.
1357. James Combe.
1427. Arthur George Baylis.
1483. John Henry Johnson.

EXTENSION.

Sealed August 8th, 1856.

13. John Lee, Brunswick-street, Trinity-square, Southwark—Certain improvements in wheels and axle-trees to be used in railways, and in machinery for stopping or preventing such carriages from running off railways, which improvements might also be applied to other carriages and machinery.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

August 5th.

1838. John Hughes.
1839. John Marten.

August 6th.

1856. William Baines.
1863. Samuel Hall.
1876. William Longmaid.
1869. Thomas Allan.

August 7th.

1862. Thomas Mac Sweny.

August 8th.

1874. George Deards.
1911. Richard Archibald Brooman.

August 9th.

1870. Richard Farmer Brand.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3865	July 31.	United Service Square	Charles William Lancaster ...	New Bond-street.
3866	Aug. 2.	The Compound Spade Plough	William Chamberlain...... ...	Dodbrook.
3867	Aug. 4.	Hobble for Cattle	William Middlemore...........	Birmingham.

Journal of the Society of Arts.

FRIDAY, AUGUST 22, 1856.

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ON MERCANTILE STEAM TRANSPORT ECONOMY.

A Paper read by Charles Atherton, Chief Engineer of Her Majesty's Dockyard, Woolwich, at a Meeting of the British Association, held at Cheltenham, in August, 1856.

(*Concluded from page* 653.)

Having already defined the measurement of the units by which we propose to designate the working power of the engines and the size of the ship, namely, ind. h.p. at 33,000 lbs. raised 1 foot high per minute, and tons weight of displacement at 35 cubic feet of water to the ton, it is now necessary that we refer to the received law or formula by which the comparative dynamic duty of steam-ships may be numerically ascertained. The formula usually adopted for obtaining the co-efficient of dynamic duty of steam ships is $\left(\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C\right)$ in which D is the displacement of the ship at the time of trial expressed in tons weight, V the speed (usually expressed in nautical miles per hour) and ind. h.p., the working power as ascertained by means of the indicator. The resultant number C deduced from this formula is termed the co-efficient of dynamic performance. This co-efficient C will be a constant number for all vessels of perfectly similar model or type of form, and of which the engines are equally effective in proportion to their gross ind. h.p., but if the vessels be not of similar type, and the engines not equally effective in proportion to their ind. h.p., the co-efficient C will vary, and thus the dynamic performance of different vessels will be *comparatively* ascertained. It is not our purpose in this paper to raise any question as to the scientific rationale or resultant accuracy of this formula; I will merely observe, that though open to criticism in several respects, the results of experience have demonstrated that this formula, when applied to any known type of ship, expounds the mutual relations of displacement, power, and speed, with a degree of precision that admits of its being practically made use of for determining the resultant speed that is to be expected from any combination of power and displacement, and in like manner, any one of the three elements of the formula may be deduced from the other two being given. Further, this formula may be rendered available as a counting-house check on the working operation of steam-ships, simply by substituting the consumption of coals, expressed in cwts. per day of 24 hours (W), in lieu of the ind. h. p.; for 1 cwt., or 112 lbs., per day of 24 hours is at the rate of 4·66 lbs. per hour, which is probably about the ordinary consumption per ind. h. p. per hour, and it ought not to be exceeded. If, therefore, in lieu of the ind. h. p. we substitute the consumption of coals, calculated in cwts. per day of 24 hours, the resultant co-efficient (C) will afford an approximate indication of the good or bad performance of ships, as compared one with another, and the fact of an inferior performance being thus detected, the cause to which it may be attributable, whether to inferior type of form or foulness of bottom, or inferior adaptation of engine, or inferior construction of boiler, or inferior management on board ship, will then become the subject of professional inquiry; thus, the merchant, by aid of his counting-house statistics of displacement, time on passage of given length, and coals consumed, will be enabled to detect the fact of inefficiency, and it will then be for the professional engineer to detect and remedy the cause thereof. The annunciation of the formula, or the mercantile rule above referred to, is as follows:—Multiply the cube of the speed, expressed in knots or nautical miles per hour (V^3), by the cube root of the square of the displacement ($D^{\frac{2}{3}}$), and divide by the consumption of coals, expressed in cwts. per day of 24 hours, the resultant numeral co-efficient (C) will indicate the dynamic or locomotive efficiency of the vessel; and, such is the variable condition of steam-ships in present use, that the co-efficient has been found to be as low in some cases as 120, whilst in other cases it has reached the number 250. The pecuniary value of gold is determined by assay; and in like manner the contract price to be paid for a steam-ship should, in some measure, be regulated by the co-efficient, based on the mutual relation of displacement, speed, and coals, which may be realised on trial of the ship; for example, multiply the contract price by the numeral co-efficient that may be actually realised, and divide by the co-efficient that may be regarded as the *par* measure of dynamic efficiency, according as the vessels may be painted or sheathed with copper. Contracts based on this principle would constitute a check upon the production of inefficient ships, and award a premium on the construction of ships of superior merit.

The approximate trustworthiness of the formula $\left(\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C\right)$ being conceded, we now have the means of pursuing our exposition of the extent to which any definite difference of type or falling off in the working condition of a ship will affect the amount of prime cost expenses incurred in the conveyance of merchandise by steam-ships. Suppose, for example, that we have ships whose co-efficients of dynamic duty or index numbers (C) deduced from the formula $\left(\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C\right)$ are respectively 250 and 166, which numbers correspond with 1,000 and 664, if the unit of marine engine-power be taken at 4 ind. h.p., as is the case in the tabular calculations given in Atherton's "Steam-ship Capability," and are co-efficients of dynamic duty not unusual as between different steam-ships in actual practice; in evidence of which, confirmatory of the official records whence these numbers are taken, I may refer to a tabular statement of steam-ship trials recently supplied to me by one of our most experienced firms (engineers and shipbuilders), by which statement it appears that, adopting the formula referred to, the index numbers or co-efficients of dynamic duty of eight steam-ships varied from 251 to 149, thus showing that the difference of constructive types now assumed as the base of calculation for this exposition, is not an exaggeration, but such as is common in practice. In the first place, referring to "Steam-ship Capability," 2nd edit., page 78, we will expose the difference of power (ind. h. p.) which would be required by two vessels, A and B, of the respective types or working conditions of service indicated by the co-efficients above referred to (namely 250 and 166), supposing the vessels to be each of 2,500 tons load displacement. The vessel A will be propelled at 8 knots, 10 knots, and 12 knots per hour, by 376 ind. h. p., 736 ind. h. p., and 1,272 ind. h. p.; but the vessel B will require, to attain the same rate of speed, 568 ind. h. p., 1,112 ind. h. p., and 1,920 ind. h. p. Thus the ship B requires, in consequence of her inferiority of working condition, or type of construction, an increase of power of no less than 50 per cent. in order to attain the same rate of speed as ship A; and, be it observed, that these assumed co-efficients are within the range of ordinary difference between one ship and another.

We will now show the sacrifice which such a difference of type produces in the weight of cargo which these ships of (say) 2,500 tons displacement, with mean quantity of coal on board, would respectively carry on a given passage, if powered for running at the speed of 8, 10, and

12 knots per hour. For this exposition we will assume the weight of the ships themselves, as measured by the light displacement of ships, when ready to receive cargo and coal for the voyage, to appropriate 1,000 tons displacement, being 40 per cent. of the load displacement. We will also assume the weight of the engine department complete at 5 cwts. per ind. h. p., and the consumption of coal to be at the rate of 4lbs. per ind. h. p. per hour, and the length of passage, without re-coaling, to be 3,250 nautical miles, being about the distance from Liverpool to New York or to Constantinople. On these data, according as the vessels may be powered, as before shown, for being propelled at the speed of 8, 10, and 12 knots per hour, the displacement available for cargo in A will be 1,270 tons, 1,103 tons, and 875 tons weight of cargo; while in B it will be 1,152, 900, and 556 tons weight. The consumption of coal in A will be 273 tons at 8 knots, 427 tons at 10 knots, and 615 tons at 12 knots; and in B it will be 412, 645, and 929 tons weight. Hence it appears that purely in consequence of the difference in constructive type, or working condition of the ships, the reduction of cargo in B, as compared with A, will be 9, 18, and 36 per cent., according as the speed may be, 8, 10, or 12 knots per hour; while the increase of coal, being in proportion to the increase of power, will, in each case, be 50 per cent. But the public evils of an inferior type, or neglected condition of ships, will be still more fully exposed and be more definitely understood by the extra £ s. d. charge that must be made for freight per ton weight of goods conveyed, in order to meet the prime cost expense of conveyance. In order to work out this calculation, we must assume certain data of investment and current expense as constituting the prime cost charges of permanently establishing and upholding a commercial fleet of steamships; and as this is the vital point in which the public, as consumers, have a direct interest, it will be expected that I enter upon it in considerable detail, as set forth in supplement to "Steam-ship Capability," 2nd edit. page 76.

In the first place, I would remark that it is only during the number of days that steamers are annually at sea conveying cargoes of goods from port to port that they earn the income that is to defray the whole annual expenditure incurred. The number of days per annum during which steamers are at sea will, of course, depend materially on the service in which they may be employed; and as it is proposed to work out our calculations with reference to a passage of 3,250 nautical miles—such, for example, as the passage from England to New York or to the Black Sea—I have assumed that the vessels employed on such service may be at sea 200 days per annum. In the next place, the cost of coal is a very material item, greatly dependent on the service on which the vessels may be employed. This I have assumed at £2 per ton weight as the average cost of the yearly consumption. Next, as to the ship; I have assumed that a ship of 2,500 to 3,000 tons *load displacement* would be purchased from the builders as a ship of about the same amount of tonnage, builders' measurement, and that the cost of the ship, completely fitted, equipped, and furnished in all respects ready for sea, would be £25 per ton. Then, assuming the interest on investment at £5 per cent. per annum, the upholding and replacement at 10 per cent. per annum, insurance at 5 per cent. per annum, and wages and rations of officers and crew all the year round at £3 per 100 tons per week. On these data we shall have the prime cost expenses incidental to the hull amounting to £6 11s. 2d. per ton of tonnage per annum, which is 8d. per day sea-time, assuming the vessel to be at sea 200 days per annum, exclusive of harbour dues, lights, and pilotage, which are supposed to be the same for all ships of equal tonnage.

Next, as to the engine department:—

The average price of marine condensing engines, as now usually constructed, may be rated at £50 per nominal H. P., and in general each H. P. nominal may be expected to work up to 2½ ind. h. p., so that the cost of marine engines may be rated at £20 per ind. h. p. Then, assuming the interest on investment at 5 per cent. per annum on the contract cost, the upholding and replacement at 10 per cent., insurance 5 per cent., wages and rations of engineers and stokers at £5 per 100 ind. h. p. per week, consumable stores (coal excepted) £2 10s. per 100 ind. h. p. per week, on these data we shall have the prime cost expenses incidental to the engine department (exclusive of coal), amounting to £7 18s. per ind. h. p. per annum, which is 9d. per day per ind. h. p. sea-time, assuming the vessel to be at sea 200 days per annum.

These assumed data of pecuniary charges incidental to Steam-ship Transport Service, as applied to mercantile purposes, combined with the mutual relations of displacement, power, and speed, which are derivable from the foregoing formula $\left(\frac{V^3\ D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C\right)$ according to the constructive type or locomotive quality of the ship, as shown by the co-efficient or index number C, enable us to make up the prime cost expenses, being the minimum at which goods can be conveyed, and which, therefore, should constitute the base of the estimate by which a minimum scale of freight charges should be estimated; and applying these data to the ships A and B, employed on a passage of 3,250 nautical miles, as exemplified in the supplement to "Atherton's Steam-ship Capability," 2nd edition, page 78, the minimum scale of freight charges per ton of goods, according as the vessels may be powered for a speed of 8, 10, or 12 knots per hour, will, on the data referred to, require to be as follows:—

	8 knots.	10 knots.	12 knots.
Ship A	£1 15 7	£2 4 6	£3 4 6
Ship B	2 7 2	3 9 8	6 16 3

The proportions in which goods, according to their respective kinds, may be made to bear freight charges so as to yield the average return per ton weight on the entire cargo, is altogether a matter of commercial discretion and management. The entire cargo must be made to yield the average return per ton weight here set forth.

Hence it appears that 12 miles speed involves about double the freight cost of the 8 miles speed with the superior ship A, and nearly three times the cost of the 8 miles speed with the ship B, and 12 miles speed with the ship B is about four times as expensive as the eight miles speed with the ship A. Also, the extra cost to the public at which freight charges are enhanced by the inferior type or inferior working condition of ship B, as compared with the ship A, if continuously employed on the passage of 3,250 nautical miles, and under the data referred to, assuming the consumption of coal to be at the rate of 4lbs. per ind. h. p. per hour, and according as the steaming speed of both ships may be eight, ten, or twelve knots per hour, is no less than 32 per cent. at eight knots, 56 per cent. at ten knots, and 111 per cent. at twelve knots. Undoubtedly, the details of the data on which the foregoing calculations have been based are open to correction, and will greatly depend on their application to special services on considerations immediately connected with such special service, and cannot be generalised; but, whatever alteration of these data may be applied to the ship A must likewise be applied to B, so that, although the foregoing estimate of the actual cost expenses of freight may be considerably modified by our altering the data of the calculations, still, the per-centages of difference above set forth showing the *degree* or per-centage in which freight charges for the passage of 3,250 miles are enhanced in consequence of the inferiority in locomotive properties of the ship B, as compared with the ship A, will not be much altered from the per-centages above set forth, showing an enhanced cost of freight to be paid by the public on bringing cargo, grain for instance, from the States, or from the Black Sea, to England, amounting to 32 per cent. at the eight knots speed, 56 per cent. at the ten knots speed, and 111 per cent. at the twelve knots speed, extra charges incurred on freight per ton of goods conveyed, and to be paid by the public, in consequence of the dynamic inferiority of ship B, as compared with ship A. It is surely in consequence of the public not being generally aware of the high scale of prime cost charges necessarily involved in a 12 miles speed (steaming speed at sea) as compared with an eight miles speed, that such high speed is so universally demanded by the public, and it must surely be in consequence of an almost similar want of insight into the real cost of high speed on the part of directors that obligations as to speed are so frequently incurred at a price inadequate to such service. If the public will have a progressively increasing high rate of speed, they must pay for it about in the ratio at which they purchase iron, copper, silver, gold, and diamonds, either of which may be bought too dear for common use.

The foregoing results have been based on the supposition that the consumption of fuel in both ships is at the rate of 4lbs. per hour per ind. h. p. My own experience, however, induces me to be of opinion that this rate of consumption is but very seldom realised, and that 5lbs. of coal per ind. h. p. per hour is much nearer in accordance with our present actual steaming practice. It is, therefore, important that we show to what extent the rate of transport freight expenses will be enhanced if the service above referred to, namely, 3,250 nautical miles direct, be performed with an inferior construction of boiler, causing a consumption of 5lbs. of coal per indicated horse-power per hour, instead of 4lbs., as above calculated on. In this case, according as the speed for which the vessel may be powered is eight, ten, or twelve knots an hour (see "Steam Ship Capability," page 78), the cost expenses incurred by vessel A, instead of being £1 15s. 7d., £2 4s. 6d., and £3 4s. 6d. per ton-weight of cargo, will now amount to £1 19s. 5d., £2 11s. 4d., and £3 19s. 1d. per ton weight of cargo, this increase of prime cost freight expenses per ton of goods being 11 per cent., 15 per cent., and 22 per cent., according as the service speed may be eight, ten, or twelve knots per hour, solely in consequence of the inferiority of the boiler or inferiority of boiler-management, causing this extra consumption of fuel; and further, if this greater consumption of coal be combined with the inferior type of vessel B, the prime cost expenses of freight per ton of goods, instead of being £1 15s. 7d., £2 4s. 6d., and £3 4s. 6d., will now be £2 13s. 7d., £4 5s. 5d., and £9 15s. 2d., this increase of freight cost being 18s. per ton, £2 0s. 11d. per ton, and £6 10s. 8d. per ton weight of cargo conveyed, or 50 per cent., 100 per. cent., and 202 per cent. extra charge incurred according as the service speed may be eight, ten, or twelve knots per hour. These results show the monstrous extent, in a pecuniary point of view, to which the public are interested in the general quality of the type of ships and machinery adaptation thereto, and working condition of ships by which the mercantile transport service of the country may be prosecuted. But let us look a little further into this matter, in the hope of obtaining a more definite appreciation of the total extent in £. s. d. to which the British public are interested in having their mercantile transport service performed to the best advantage. It has been publicly stated (*Times*, June 18th, 1856,) that at the 12 principal ports of the United Kingdom during the year 1855, ship tonnage to the extent of 6,372,301 tons entered inwards, and 6,426,566 tons cleared outwards, making altogether 12,798,867, say 12½ millions of tons of tonnage per annum, and since mercantile shipping will probably, *on the average*, carry dead weight of cargo to the full extent of their register tonnage, it is probable that the tons weight of merchandise constituting the cargoes of ships arriving at and sailing from the United Kingdom, amounts to no less than 12 millions of tons per annum, of which, for the purpose of illustration, we will suppose that one-sixth part, or two millions of tons, is conveyed by steam power on a passage of 3,250 nautical miles, under the circumstances of the data that have been assumed as the base of the foregoing calculations, and since we have shown under these circumstances that the prime cost expenses of freight per ton of goods may be enhanced by an inferior type of ship and machinery, or inferior management thereof, to the extent of 18s., £2 0s. 11d., and £6 10s. 8d. per ton weight of goods conveyed, it follows that the extra charges for freight on the assumed quantity of two millions of tons weight per annum, will amount to the extra annual cost or public loss of £1,800,000 at 8 knots speed, £4,916,666 at 10 knots speed, and £13,666,666 at 12 knots speed, according as the type of ship and machinery by which the work is performed may be of the inferior type B, as compared with the superior type A; seeing also that it is the public interest which has to bear the brunt of our national goods transport service, being either as respects construction or working condition anything short of that degree of perfection which the application of science might achieve, is it not, therefore, of importance, that our public system of statistical shipping registration should be complete, especially in those points which are essential for scrutinising the dynamic properties of steam-ships, thus leading to the recognition of good practice on the one hand, or the exposition of bad practice and consequent public loss on the other. Ships may be regarded as national implements for doing the work of the nation, and should, therefore, be subjected, by the aid of statistical registration, to public scrutiny, as conducive to their being upheld fit to do their work in the best manner. A shipbuilder will not allow his interests to be trifled with by the use of a blunt adze, so the public interest requires that its national transport service in the conveyance of goods should not be performed by bad ships if the statistical grindstone will obviate the evil. Nevertheless, the public statistics of British shipping afford no data available to science for promoting or even protecting from abuse the great public interests which are involved in the proper execution of its transport service, amounting probably to 12 millions of tons per annum. It is pre-eminently for the British Association to suggest the remedy for this humiliating fact.

The subject herein treated of admits of extended illustration beyond the limits of time that I may presume to occupy at a meeting of the British Association. I only profess to have broken up new ground in showing that mercantile transport service by steam-ships admits of being brought within the range of arithmetical calculation, whereby the dynamic quality of ships, the size of ships as measured by displacement, the working quality of engines and engine-power as measured by the unit ind. h. p., and the speed to be assigned as the condition of any service, may each of them be treated as functions of calculation involving definite pecuniary considerations, constituting a system which may be denominated the "arithmetic of steam-ship adaptation to the requirements of mercantile service." By the application of these principles of calculation, I submit that errors in steam-ship construction, or neglect of its working condition, may be exposed, correction will follow, the directorial management of steam-shipping affairs, as respects steam-ship capability, will be based upon arithmetical calculation, thereby prosecuting its assigned service with confidence, and rejecting all Utopian projects that will not pay. Thus, science will produce its fruit in promoting public interests, without detriment to the fair competitive pursuits of any class, by producing a sound, well-understood, and healthy condition of steam-ship management, and consequently of "Mercantile Steam Transport Economy."

ON THE MEASUREMENT OF SHIPS FOR TONNAGE,

Being a Report to the British Association for the Advancement of Science, August, 1856, from a Committee appointed at the Meeting in Glasgow, September, 1855.

The Committee consisted of the following gentlemen:—Mr. Andrew Henderson, Mr. J. R. Napier, Mr. John Wood, Mr. Allan Gilmore, Mr. Charles Atherton, and Mr. James Peake.

As the first-named member of the Committee on Tonnage Measurement, it becomes my duty to report progress in the matters referred to us, and in so doing, I beg to premise my report with the remark that I was induced to propose this Committee from having had the honour of reading a paper on Ocean Steamers, Clipper Ships, and their descriptive measurement, to the Association, at their meeting at Liverpool. (*Vide* page 152 to 156 of Report, 1854). While at Glasgow in 1855, a new Shipping Bill having come into operation, I found the extreme interest then publicly taken in the general question of Government interference in shipping affairs seemed to render this Committee expedient.

The serious and important character of the subject thereby involved, and the consequent responsibility imposed on all individuals who may take a prominent part in this matter, have operated as an obstacle to the immediate establishment and working operation of this Committee. In the first place, I beg to notice that the subject of tonnage registration, as connected with our national statistics of shipping, had been brought to the notice of the public, both at the Institution of Civil Engineers, by myself, in 1853, and at the Society of Arts, by Mr. Charles Atherton, in a manner which has fully set forth the importance of the subject, and shown that legislative enactment will be necessary in order to correct the deficiences of our present tonnage registration of shipping. The subject having been thus brought before the public in its most serious and important aspect, has apparently induced several of the gentlemen proposed for this Committee to decline the task thus expected of them.

The absence from Glasgow of many interested in the subject rendering previous communication impracticable, the President and Officers of the Mechanical section, deeming it desirable that the three scientific bodies before whom the subject had been brought should participate in the investigation, Mr. John Scott Russell was nominated to represent the British Association; and it being also considered expedient to follow the precedent of the Tonnage Committee of 1849, which comprised shipowners, shipbuilders, officers of the Royal Navy, merchant service, and Trinity House, gentlemen connected with Lloyd's Register, and their surveyors, with several naval architects and engineers, there were proposed, Mr. Allan Gilmore, Mr. John Wood, and Mr. James R. Napier, as representing the shipowners and shipbuilders of Scotland, Mr. C. Atherton and Mr. J. Peake, naval architects and engineers, with the understanding that they were to seek the co-operation of others.

Accordingly, application was made to noblemen, officers and engineers connected with the navy, the Society of Arts, and Institution of Civil Engineers, the Shipowners' Societies of London and Liverpool, the Committee of Lloyd's Register of Shipping, and to shipbuilders. Although many of these gentlemen of scientific attainments and practical experience offered to participate in the investigation, difficulty and delay occurred, from some of the members of the Committee being resident in distant parts of the country, while for the deposit of papers and plans for reference by the Committee no provision had been made, even in the metropolis; the only means of bringing them under consideration was the forwarding copies of them to the principal ports, that the members might elicit the opinion of the local Marine Boards and shipowners.

With this view, application was made to the Board of Trade for copies of Acts and Parliamentary papers bearing on the question, to be submitted to the members of the Committee of the British Association in their investigation of tonnage measurement.

The official reply was that the Board of Trade "do not consider that the law of tonnage measurement requires alteration, or that the subject requires further investigation with any view of amending the law." "Most of the papers to which you refer are published, and can be purchased. Those which have not been published, and which are among the records of this office, my lords cannot part with, but you are at liberty to inspect and take copies of the plans which you have yourself submitted to the Board."

In addition to these delays and the difficulties thrown in the way by the routine of a public office, Mr. Allan Gilmore and Mr. John Wood, of Glasgow, expressed a desire to withdraw from the committee, and Mr. Scott Russell's engagements especially in connection with the construction of the great ship for the Eastern Steam Navigation Company, have so engrossed his time and attention as to have put it out of his power to take that interest in this question which has hitherto so laudably characterised his exertions in the cause of science, in connection with the labours of the British Association.

Mr. Atherton also declined, on the ground that the public agitation of the question referred to, in which during the past year he was engaged before the Society of Arts, disqualified him for the time being from taking part on this committee; consequently, Mr. James R. Napier and Mr. James Peake were the only parties available for co-operation with myself (Mr. Henderson) in this matter, and it has, therefore, been considered most advisable, under the circumstances above referred to, not to officiate in our collective capacity as a Committee of the British Association, but simply to give our individual aid in promoting the discussions which have thus sprung up.

With this view, I have myself taken a personal interest in the discussion of the tonnage registration question before the Society of Arts, as exemplified by the documents submitted herewith, shewing a large amount of statistical data on steam-ship performances, which has been collected by me since I originally brought it before the Institute of Civil Engineers in 1847, with the view of collecting in the archives of that Institution, statistics of the progress of improvement in our mercantile marine.

The papers comprise my view as to tonnage measurement, as laid before the Board of Trade in 1850 and in 1852, and as to steam navigation and the speed realised by mail steamers as laid before Parliament in 1851, papers read before the Institution of Civil Engineers in 1853, the British Association in 1854, and published by the Society of Arts in 1855; together with the discussions that have taken place in the *Journal* of that Society, in 1856, on Mr. Atherton's paper on "Tonnage Registration." The system of measurement I proposed to the Board of Trade in 1850, was exemplified by a *pro forma* certificate of survey, appended to the paper, as well as by a tabular analysis of the proportion and displacement of different ships and modes of measurement, and including the paper read before the Association last year, and subsequent information, as well as proposed new rules, will be printed complete, before submitting them to the consideration of any Committee or authority that will investigate the whole question.

Mr. James R. Napier has, I understand, during the past twelve months, collected much statistical information on the trial performances of steam ships, and Mr. Peake has taken the opportunity of drawing public attention to the question of the mode of measurement most available for shipping operations; by these means I beg to bring to the notice of the general committee, that the individual labours of Mr. Atherton, Mr. Napier, Mr. Peake, and myself, have now contributed materially to the elucidation of the subject referred to, thereby facilitating any further effort that may be decided on. The favourable manner in which Mr. Atherton's paper on the analogous subject of "Mercantile Steam Transport Economy" has been received at the mechanical section of the Association, affords every prospect of the labours of this committee being now prosecuted under far more encouraging prospects of public support and co-operation, on the part of the shipping interests themselves, than has hitherto been the case.

As an example of the benefit to be derived from public discussion, I may refer to the numbers of that popular work, the *Mechanics' Magazine*, published during the months of April, May, and June last, in which, after fully investigating the subject of the deficiencies of our present tonnage registration for scientific purposes, the editor has been pleased to announce the following admitted deficiencies and proposed corrections of our present system for the consideration of its numerous readers:

First,—"That the tonnage, measurement, and registration of vessels has never been brought before government in any other than a purely fiscal point of view."

Secondly,—"That government in legislating on tonnage registration has not contemplated the scientific features of the case, nor those which bear on the sea voyage."

Thirdly,—"That undoubtedly there is a point beyond which ships cannot be safely loaded."

Fourthly,—"That undoubtedly it would be desirable, if possible, to fix a limit to the degree to which ships may be loaded."

Fifthly,—"That as respects the draft of water at which ships leave port, let the Board of Trade have, if it so pleases, properly authorised officers to note and record the facts."

Sixthly,—"We would see with satisfaction a competent committee appointed by Government, or by the British Association, with a view of ultimately, if need be, acting on the Government, to take into consideration the foregoing points."

Such being the declaration of opinions expressed by the editor of the *Mechanics' Magazine*, one of our most popular periodicals devoted to science, in respect to the deficiencies of our present system of statistical registration of tonnage, it is respectfully submitted that good and sufficient cause is shewn for the re-appointment and further continued labours of the committee on this subject, and that under such indications of the public appreciation of the utility of such labours, there can be no doubt of such amendments of the present system being obtained as will conduce to public good.

It may be in the recollection of members that at the meeting of the British Association at Liverpool, in 1854, the recommendations of the General Committee included one, "That it was expedient for the advancement of naval architecture, that a portion of the intended Museum at Liverpool should be appropriated to this subject." Little progress having been yet made with the Museum at that port, while the want of such an establishment for the record and disposal of papers and models, added to the difficulties of the committee of 1855, it is with satisfaction I have to state that such difficulties may be considered removed for the future, by the considerate offer of the Chairman of the Crystal Palace Company, Mr. Arthur Anderson, to lend the Naval Gallery of the Palace in any manner that can aid the objects of the Committee, or ventilate the subject.

Considering that there are already collected at the Crystal Palace naval gallery, models of ships and steamers, fishing boats, and life-boats, both English and foreign, ancient and modern, a comparison can be there made of the rapid improvement in shipping and steam vessels since the old tonnage law was abandoned, the great desideratum being that on the six points enumerated the question shall be better understood, and facilities afforded for investigation and the re-examination of our system of measurement and registration. The vast advantages that would thereby accrue to our mercantile marine, will, it is to be hoped, induce every effort to be made by the British Association.

ANDREW HENDERSON.

Cheltenham, August 8, 1856.

Subsequently, at the General Meeting of the Association, held August 13, 1856, the following resolution was passed:—

"That the Committee, consisting of Mr. Andrew Henderson, Mr. John Scott Russell, Mr. Jas. R. Napier, Mr. Charles Atherton, appointed to consider the question of the measurement of ships for tonnage, be requested to continue their investigations, that the following members be added to the Committee:—The Right Honourable the Earl of Hardwicke, Arthur Anderson, Esq., The Rev. Dr. Woolley, William Mann, Esq., G. F. Young, Esq., Capt. T. P. Owen, Professor Woodcroft, and Mr. James Perry; and that they be requested to inquire into the defects of the present method, and to frame more perfect rules for the measurement and registration of ships, and also as to the adoption of a standard unit for estimating the working-power of engines instead of the present nominal horse-power, in order that a correct and uniform principle of estimating the actual carrying capacity and working-power of steam ships may be adopted in their future registration."

REPORT OF THE COMMISSIONERS OF PATENTS.

This report, which is dated 21st July, 1856, shows that the number of applications for patents made in the year 1855 was 2,958; the number sealed thereon, 2,044; the number of specifications filed, 1,989; and the number lapsed, 914. The number of applications during the first six months of 1856 has been 1,534. Out of 2,047 patents, in respect of which the third year's duty of £50 has become payable, 619 only have complied with the condition, leaving 1,428 (upwards of two-thirds) to become void by reason of non-payment.

Balance Sheet of Income and Expenditure for the Year 1855.

Receipts.

	£	s.	d.
In stamp duties in lieu of fees	73,582	6	2
By sale of prints of specifications, indexes, &c.	1,286	15	2
Surplus income on balance of accounts, from the 1st of October, 1852, to the end of the year 1854	15,672	5	9
	90,491	7	1
Surplus income*	38,748	16	1

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* The Revenue stamp duties upon patents for inventions previous to the Act of 1852 (£33 upon each patent) produced upon the average £16,500 per annum.

The Act of 1852, in lieu of the old duties, imposed a Revenue stamp duty of £5 upon the warrant of the law officer, £10 upon the certificate of payment of the progressive fee of £40 at the expiration of the third year, and £20 upon the certificate of payment of the fee of £80 at the expiration of the seventh year of the patent.

The Act of 1853 (16 Vict. c. 5) converted all the fees imposed by the Act of 1852 into stamp duties.

The Revenue stamp account from the 1st October, 1852, to the 31st December, 1855, stands as follows:—

PAYMENTS.

	£	s.	d.
Fees to the law officers of England	8,197	7	0
Their clerks	739	10	0
Salaries of officers and clerks in the Commissioners' office	4,003	7	5
Compensations	4,584	0	0
Current and incidental expenses in the Commissioners' office	3,962	4	10
Estimated cost of stationery supplied by Her Majesty's Stationery Office.........	485	4	8
Rent of offices and library	490	0	0
Messrs. Eyre and Spottiswoode, for printing specifications of patents, indexes, &c.	8,154	3	0
Lithographers' bills for drawings accompanying specifications	12,607	18	2
Estimated cost of paper supplied to printer and lithographer by Her Majesty's Stationery Office...............	5,015	7	6
Expenses incurred by Her Majesty's Office of Works, &c., in altering, fitting, and furnishing the offices, and in constructing fireproof room for the deposit of specifications, &c.	3,503	8	5
	51,742	11	0

In a supplemental report the Commissioners refer to the foregoing balance-sheet, as showing that the only surplus remaining to the credit of the Patent Office is £3,648 16s. 1d., and that until the printing of the old specifications is completed, and the second progressive stamp duty of £100 comes into receipt (Oct. 1859), there can be no large available surplus. The Commissioners estimate the surplus for the current year to be £14,000, and that the same amount may be expected annually till 1860. From this surplus, however, they estimate that from £20,000 to £25,000 must be appropriated to the purchase, fitting, furnishing, and alteration of the building, late the offices of the Masters in Chancery.

Of the old specifications, numbering 12,977, 3,500 have already been printed, and 500 more are in the printer's hands, and it is intended to print at the rate of about 2,500 annually, so as to complete the whole in 1860.

The large and valuable collection of models made by Mr. Woodcroft have been sent to Kensington Palace, and it is intended they should be placed in the new building now being erected at Kensington Gore, and inventors are invited to send models to the Patent-office for the purpose of their being transferred to Kensington Gore.

The Commissioners of Patents have presented complete sets of their publications to numerous public bodies in the kingdom, "on condition of their being daily open to the inspection of the public free of charge." The gift has in most cases laid the foundation of public free libraries where none previously existed. The following is a list of the places which have received the works:—Aberdeen, Accrington, Admiralty, Chatham Dockyard, Deptford Dockyard, Devonport Dockyard, Pembroke Dockyard, Portsmouth Dockyard, Sheerness Dockyard, Surveyor of Navy, Steam Department, Woolwich Dockyard, Ashton-under-Lyne, Beverley, Birmingham, Board of Ordnance, Board of Trade, Bolton-le-Moors, Bradford (Yorkshire), Brighton, Bristol, Burnley, Cambridge Town, Cambridge University, Canterbury, Carlisle, Cork, Crewe, Drogheda, Lord Lieutenant of Ireland, Royal Dublin Society, Falmouth, Galway (Queen's College), Gateshead, Gorton, Glasgow, Grimsby (Great), Hertford, Huddersfield, Hull, Ipswich, Keighley, Kidderminster, King's Lynn (Norfolk), Lancaster, Leeds, Leicester, Liverpool, British Museum, Great Seal Patent Office Free Library, Marylebone Free Library, University College, Macclesfield, Cheetham Hospital Library (Manchester), Royal Free Library (Manchester), Newark (Nottingham), Newcastle-upon-Tyne, Newport (Monmouth), Northampton, Nottingham, Oxford (Corporation), Plymouth, Preston, Reading, Rochdale, Rotherham, Salford (Peel Park), Sheffield, Shrewsbury, Small Arms Factory (Enfield), Southampton, Stirling, Stockport, Sunderland, Warrington, Waterford, Wednesbury, Wigan, Wolverhampton, Wolverton, Woolwich (Royal Artillery Institute), Great Yarmouth, York.

As evidence that such gifts are appreciated and turned to account, the Commissioners refer to the third annual report of the working of the Manchester Free Library, and to communications from Salford, Newcastle-upon-Tyne, Kidderminster, and from the Marylebone Free Library. The report of the Manchester Free Library, dated 31st October, 1855, states:—

"Early in the summer a public exhibition was made of a collection of diagrams, illustrative of Patent Inventions, in three several classes:—1. Reaping and mowing machines; 2. Fire-arms and projectiles; 3. Improvements in fire-places, furnaces, and steam boilers, having in view the economising of fuel and the prevention of smoke. The collection extended, in the first class, to fifty-five sheets of diagrams, illustrative of thirty-eight several inventions, twenty of which were the subjects of Patents, and eighteen had not been patented; in the second class, to 158 sheets of diagrams, illustrative of 101 Patents; and in the third class, to 141 sheets of diagrams, illustrative of 109 distinct Patents.

"The exhibition was visited, during twenty-four days, by 3,115 persons, and it led to a very noticeable increase in the numbers of readers on the subjects to which it related, not only as regards the specifications and the indexes of the Patents themselves, but also in respect of various scientific periodicals and other works in which similar matters are treated of. It led also to the expression of earnest wishes for the formation of a permanent collection of models, and specimens of machinery and implements, and of industrial products and fabrics of all kinds in connection with such a series of books and diagrams as should adequately explain and illustrate them. Of the importance of such a trade museum in Manchester it would be superfluous to say a word; and it can scarcely be matter of doubt that its intrinsic value would be considerably enhanced by conjunction with such a collection of standard works in technology as it may be fairly hoped the free library will ere long contain."

From Salford, the curator of the Royal Museum and Library writes, under date of April 7, 1856:—

"The period over which the specifications have been in service at the library extends to eleven months, and during this time they have been consulted or referred to by practical mechanics and operatives to an extent beyond what was at first expected, knowing that it would not be easy, or would be at least a work of time. to extend a knowledge of their importance and value to that class of persons who, from their pursuits and ingenuity, ought to be the first to benefit by their consultation.

"The monthly issues have varied in number, but the general average will show that as many as 253 references per month have been made.

* * * * *

"I have endeavoured, as far as it is now feasible, to ascertain if references to any special class of inventions in machinery were to be found to any extent in the issues, and am gratified to report that this has actually been the case, very numerous applications having been made for those Patents relating to

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	£	s.	d.
6,382 warrants of the law officers for patents, at £5 each	31,910	0	0
319 patents on which the progressive duty of £50 has been paid at the end of the third year from their respective dates, between the 1st October and the 31st December, 1855 (£10 being Revenue stamp duty, and £40 fee stamp duty), 319 at £10 each	3,190	0	0
	£35,100	0	0

The above-named surplus of £38,748 16s. 1d. is therefore liable to the deduction of £35,100, on account of Revenue stamp duty, leaving a surplus to the credit of the Patent Office, on balance of accounts from October, 1852, to the end of 1855, of £3,648 16s. 1d.

> 'Improvements in the Working Power of Engines,' to those also for every kind of spinning and weaving looms, and for Patents describing inventions for dressing fibres of cotton, wool, and silk. The number of the special references has been almost equal to one-half the whole issues recorded.
>
> "I may also state, that the majority of the persons who have hitherto consulted the Specifications are working mechanics, foremen, managers, and overlookers of firms belonging to this and the neighbouring districts; others are inventors and patentees who are anxious to examine the claims of existing correlative patents, so as to avoid infringement upon their patent rights; and others, perhaps the smallest class, who are interested in the general progress of the mechanical arts and of science, examine the whole of the Patents as they are received at the library.
>
> "There can be no doubt that as the knowledge of the deposition of this great collection of Patents at this free library becomes more extended in the workshops of the machinists, the foundries, and the mills, so will its utility and value increase, and the references may be in much greater number than they at present are."

From Newcastle-on-Tyne, the secretary of the Literary and Philosophical Society writes:—

> "1. The works were placed in the custody of the Literary and Philosophical Society, whose rules have been modified so as to allow the public free access to them. A press has been placed in the large room of the Institution for their reception.
>
> "2. The works when handed to the Society were not bound, and lay for some time awaiting the authority of the Council for having them bound. During this time (some three or four weeks) they might be consulted from ten a.m. till ten p.m. daily, except on Sundays. They are now in the hands of the binder.
>
> "3. They were chiefly consulted by manufacturers and the managers of manufactories.
>
> "4. Whilst they remained in the library they were frequently consulted, and *have been followed to the binder's shop*.
>
> "5. The references have been made to various classes of inventions, but especially to those relating to the washing and smelting of ores, the consumption of smoke, using gas as a heating agent in smelting ores, and generally as to mechanics and chemical manufactures.
>
> "There is no doubt that when the specifications are available they will be referred to extensively."

From Kidderminster, the librarian writes:—

> "The public have had access to them for the last nine months. The monthly issues at first were very small, but have lately been considerably increased.
>
> * * * * *
>
> "The class of inventions most referred to has been that in machinery, and looms for the manufacturing of carpets.
>
> "About two-thirds of the persons who consult the specifications are mechanics, overlookers, and working men engaged in the various trades in the town and neighbourhood; the remaining one-third being carpet manufacturers, spinners, &c., who appear to evince great interest in examining all the recent inventions which may be made applicable to the improvement of the staple manufacture of the town.
>
> "As the collection of patents already deposited in the free library here becomes more generally known in the numerous mills and workshops, there is every reason to believe that its value and utility will increase, and also the number of references in proportion at the same time."

From the Marylebone Free Library, the secretary and librarian writes:—

> "The rules of the Institution enable the public to consult the specifications for twelve hours every day. (10 a.m. till 10 p.m.)
>
> "The works are chiefly consulted by workmen. The number of monthly issues for reference is about 500. All descriptions of inventions have been referred to, but especially those relating to steam appliances."

These opportunities of consultation the report states, have led to an increased number of applications for patents:—in Manchester and Salford, 168 as compared with 141.

The low rate of postage, and cheap publication of separate specifications, have led to daily applications to the office for their transmission. The Commissioners' library for free consultation at their offices continues to be well frequented by men of all classes, and a valuable collection of works of reference has been purchased by the Commissioners and added to those lent by Mr. Woodcroft. Besides this addition to the library, the system of interchange of publications with other bodies has led to numerous gifts of official and scientific publications from the governments of foreign States. The library accommodation is, however, still insufficient. With reference to the indexes of foreign patents, the report states that the valuable table of contents prefixed to Schubarth's Indexes, has been translated by the Commissioners.

In the East Indies and in the Colony of Victoria legal protection for inventions can now be obtained, laws for that purpose having been specially enacted. Complete sets of the Commissioners' publications have been sent to the East Indies (5 sets), Victoria, Cape of Good Hope, Ceylon, Malta, Mauritius, Trinidad, British Guiana, Canada, Quebec, Toronto, New Brunswick, Nova Scotia, Newfoundland, Prince Edward's Island, Jamaica, Antigua, Barbadoes, New South Wales, South Australia, Tasmania, New Zealand.

Patents for inventions or equivalent concessions of privileges may be obtained in the following foreign states. The former is denoted by the letter "P" and the latter by the letter "C" being prefixed to the name:—P. America (United States); C. Anhalt-Bernburg; C. Anhalt-Coethe; C. Anhalt-Dessau; P. Austria; P. Baden; P. Bavaria; P. Belgium; C. Bremen; C. Brunswick; C. Chili; P. Denmark; P. Dutch West Indies; P. France; C. Frankfort; P. Greece; C. Hamburg; P. Hanover; C. Hesse-Cassel; C. Hesse-Darmstadt; C. Hesse-Homburg; C. Hohenzollern-Hechingen; C. Hohenzollern-Sigmaringin; P. Holstein; C. Ionian Islands; C. Lippe-Detmold; C. Lippe-Schaunburg; C. Lubeck; P. Lucca; C. Mecklenburg-Schwerin; C. Mecklenburg-Strelitz; P. Modena; C. Nassau; P. Netherlands; P. Netherlands' West Indian Colonies; C. Oldenburg; P. Palatinate and Rhenish Bavaria; P. Parma, Piacenza, Quastalla; P. Poland; P. Portugal; P. Prussia; C. Reis-Ebersdorf; C. Reis-Greitz; C. Reis-Schleiz; P. Roman States; P. Russia; P. Sardinia; C. Saxe-Altenburg; C. Saxe-Coburg-Gotha; C. Saxe-Meiningen; C. Saxe-Weimar-Eisneach; P. Saxony; P. Schleswig; C. Schwarzburg-Rudolstadt; C. Schwarzburg-Söndershause; P. Sicilies (Two); P. Spain; P. Sweden and Norway; P. Tuscany; C. Waldeck; P. Wirtemburg.

In Switzerland, patents for inventions are not granted, but natives of that country patent and produce their inventions in other countries. One Swiss, it is stated, has taken out seventeen patents in England.

The Commissioners' works have, on application, been furnished to France, the United States, Austria, Prussia, Bavaria, Saxony, Hanover, Sardinia, Belgium, Holland, Wirtemburg, and Russia. The report states that many of the provisions of the English Amended Patent Law are proposed for adoption in France and the United States. Preliminary examination has been abolished in France since 1844. Mr. Justice Mason, Commissioner of Patents in the United States, in his report to Congress in reference to this subject, says:—

> "The multiplicity of business of the office renders it wholly impossible for the Commissioner to exercise a personal supervision over the decision in each of the numberless cases presented for official action. When the examiner reports in favour of granting a patent, it is issued without further question or examination. Under such circumstances the importance of correctness and uniformity of decision upon the first examination can hardly be too highly appreciated. This cannot reasonably be hoped for under the system now in operation, *and the more that system is extended the greater the evil becomes.*
>
> "All our republican notions of propriety revolt at the idea of making the substantial rights of property of any citizen depend upon the mere discretion of an executive officer. Such a system seems rather Asiatic than Anglo-Saxon in its type and character. * * When an application, which should be patented, is rejected by this office, no opportunity is allowed the applicant for showing the justice of his claims before a court or jury. If

he has a natural right to what he has created, may not he in such circumstances be regarded as having been 'deprived of his property without due process of law,' and without the intervention of that great constitutional bulwark which he regards as a birthright—a fair trial before a regular judicial tribunal?"

Mr. Justice Mason, in writing to the English Commissioners, says:—

"The admirable example you have set in publishing the specifications and drawings in full, and putting them on sale at a moderate price, so that all can easily provide themselves with what they need for private use, will, ere long, I trust, stimulate our own government to do the like.

"Nothing short of this in the way of publication can give permanent satisfaction."

It is proposed in the United States to print 4,000 copies of each specification. The English Commissioners print 250 copies only, at an average cost of 10d. each, and the report states, that if 4,000 copies were printed, the cost would not exceed 10 cents. each. From America, France, Prussia, and Sardinia, the list of patents is regularly, and at short intervals, published in the Commissioners' Journal.

The report concludes by strongly recommending patentees to lithograph their drawings, as a certain mode of obtaining *fac-simile* copies for their specifications, it being found that the true copies which the law directs each inventor to file are frequently incorrect, causing much trouble, delay, and expense. By arrangement with the Commissioners' lithographer, two lithograph prints, it is said, may be obtained at a reasonable cost.

In the appendix is given the following

TABLE showing the NUMBER of PATENTS granted in ENGLAND, FRANCE, and the UNITED STATES, respectively, during the last Ten Years.

Year.	England.		United States.		France.
	Patents.		Application for Patents.	Patents granted.	Patents.
1846	493		1272	619	2088
1847	493		1531	572	2150
1848	388		1628	660	853
1849	514		1955	1076	1477
1850	518		2193	995	1687
1851	355		2258	869	1836
1852	469				
	Amendment Act.				
	Applications for provisional protection	Patents passed thereon			
1852	1211	914	2639	1020	2469
1853	3045	2185	2673	958	3111
1854	2764	1876	3324	1902	3492
1855	2958	2044	4435	2024	4056

ON THE APPLICATION OF CORRUGATED METAL TO SHIPS' BOATS AND OTHER FLOATING BODIES.

By MAJOR VINCENT EYRE, F.R.G.S., BENGAL ARTILLERY.

BEING A PAPER READ BEFORE THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, CHELTENHAM, AUGUST, 1856.

1. In a work just issued from the press, by Mr. Ruskin, and pronounced, by a leading critical journal, to be "a prose poem worthy of a nation at whose throne the seas, like captive monsters, are chained and bound," the author has uttered a rhapsody on "The Boat," which, with strict poetical justice, he describes as *par excellence*, the "most perfect work of human hands." "Beautiful in its curve, and perfect in its use, for," he adds emphatically, "*it will keep out water*."

2. Doubtless this is, or ought to be, its chief recommendation, and one, too, of immense practical benefit to the human race, when realised; but, how many instances annually occur of loss of life from the leaky and defective state of ships' boats when suddenly required for use in an emergency at sea.

3. In the present day, when our busy population is ever on the move, and when, as stated in the latest Parliamentary returns, our commercial marine numbers upwards of 35,000 ships, trading to all parts of the world, and conveying backwards and forwards continually many hundreds of thousands of our fellow-countrymen and countrywomen to and from the extreme ends of the earth, it surely behoves us to examine this matter carefully, and endeavour to apply an effective remedy, if such be found to exist, to what all must admit to be a very serious and afflicting evil, plunging, as it does, an immense number of families, year by year, and month by month, into irreparable misery and misfortune.

4. It is in the nature of us men to shut our eyes to possible evils, in the eager prosecution of probable good; hence, very few indeed out of the mass of passengers by sea, trouble their minds much about the chance of wreck, or fire, or other sudden disaster, overtaking the ship which carries "Cæsar and his fortunes," and fewer still, as they pace up and down the deck, cast an eye of interest, or even of common curiosity, at the boat which hangs suspended at the davits, or stowed amidship, bottom upwards, and on which, in case of any serious mischief befalling the vessel, would depend the sole chance of life of every individual on board. They are satisfied with the fact that a boat is there, and they take too readily for granted that, when required, it will be found serviceable and trustworthy.

5. But the annals of disasters by sea too plainly prove that, in very many cases, such confidence is sadly misplaced; for, in consequence of the wooden planks having shrunk, from long exposure to the sun, or from other accidental causes, the boats are too often found deficient in that which Mr. Ruskin considers their chief claim to glorification, for, in plain terms, *they will not keep out the water*. Neither, in cases of fire, will they resist the flames; nor, in the hard strife of elements, are they possessed of sufficient strength and tenacity to resist the violent concussions to which they are subjected against the sides of the ship; and so, from one cause or another, they oft-times fail in time of greatest need, and the helpless passengers and crew are victimised, as a necessary consequence.

6. Here, then, is a wide and important field for the beneficent interposition of mechanical science, to provide more adequate means of safety for those "who go down to the sea in ships, and occupy their business in the great waters," by the invention of a boat equal to every emergency, in whose capabilities to resist the combined effects of air, fire, heat, water, dry rot, and other destructive agents, the fullest reliance may be securely and unhesitatingly placed; and it can scarcely fail to be a matter for rejoicing to the many ardent and distinguished votaries of science here assembled, to learn that this combined triumph of humanity and engineering skill has been effectually accomplished, and that, henceforth, no ship's passengers and crew need lack such means of safety for all on board as are presented in a perfectly sound, strong, enduring, and indestructible boat.

7. For this triumph of mechanical skill the world is indebted to Mr. Joseph Francis, of New York, a man whose name has, till very recently, been scarcely heard on this side of the Atlantic, though not without honour in his own country as appertaining to a mechanical genius of a very high order, combined with that inobtrusive modesty and genuine worth which has been the usual accompaniment of true greatness in all countries, and throughout all ages of man's history.

8. For 35 years of his life Mr. Francis has been engaged in the occupation of boat-building, and has, perhaps, devoted more earnest and intelligent consideration to the improvement and perfection of that beautiful art, and with greater success than any other man on the face of the globe. For about a quarter of a century his labours were confined, not without excellent results, to boats of wood, till at length he commenced a course of experiments with metal, which led to the conception and eventual completion of that admirable method which it is my present object to place on record before the members of this learned Association.

9. It may be well to mention, *in limine*, that very heavy expense has attended the perfection of the machinery and manufacture of the inventions about to be introduced to your notice, and, although this is a matter in which the proprietor alone is concerned, still, when improvements are made which have for their object the preservation of life, such a fact is worthy to be duly appreciated by those whose safety is thereby secured, as well as by every philanthropic mind.

10. To proceed with my subject, allow me to direct your attention to the models before you. The first is that of a man-of-war cutter[*], furnished with an air chamber at each end for additional safety, thus constituting it, in point of fact, a life-boat; and this leads me to remark, that there is no good reason why all ships' boats should not, in this respect, be life-boats in future. An Act of Parliament, I believe, enjoins that every passenger ship should have at least one "life-boat" for the safety of the passengers (the poor crew apparently count for nothing), but it is quite notorious that this rule is, in very many cases, evaded, and the so-called "life-boat" is so in name only. I am assured of this fact by a gentleman holding office in the "National Life-boat Association," and it seems scarcely creditable to a great commercial people like ourselves. Surely the Board of Trade might look to it.

11. In America it is otherwise. Let me read you, by way of contrast, some brief extracts from the "Steamboat Law of that country:"—

> "Sec. 4. And be it further enacted, that every such vessel carrying passengers shall have at least *two good and suitable boats*, supplied with oars, in good condition at all times for service, *one of which boats shall be a life-boat made of metal, fire-proof, and in all respects a good, substantial, safe sea-boat*, capable of sustaining, inside and outside, fifty persons, with life-lines attached to the gunwale at suitable distances. And every such vessel of more than five hundred tons, and not exceeding eight hundred tons measurement, shall have *three life-boats*; and every such vessel of more than eight hundred tons, and not exceeding fifteen hundred tons measurement, shall have *four life-boats*; and every such vessel of more than fifteen hundred tons measurement shall have *six life-boats*; all of which boats shall be well furnished with oars and other necessary apparatus: Provided, however, the inspectors are hereby authorised to exempt steamers navigating rivers only from the obligation to carry of the life-boats herein provided for more than one, the same being of suitable dimensions, *made of metal*, and furnished with all necessary apparatus for use and safety; such steamers having other suitable provisions for the preservation of life in case of fire or other disaster."

12. Now, you will observe, that it is not left optional to the shipowners of the United States, as it is with us, to supply any description of rubbish they please, and call it a "life-boat." The United States government have taken the trouble to ascertain for their subjects which is the best and safest boat for the purpose, and have ordered that to be used in preference to all others, and the choice you will perceive has fallen on the metallic life-boat of Mr. Francis, which they justly describe as "fire-proof." But it has also some other very admirable qualities, which I will presently explain.

13. So satisfied is the American government of the superiority of these boats over all others, that it has been for some years past introducing them gradually into the United States navy, to replace those of wood as the latter become unserviceable. It has also stationed them at intervals along several hundred miles of coast, to rescue shipwrecked persons, and they have never yet been found to fail in that country.

14. Now, when these and other interesting facts came to my knowledge, about a year ago, I thought them worth looking into, and, finding on my arrival in England from a prolonged sojourn in the East, that the fame of these inventions had failed to reach the ears, or to arouse the sleepy faculties of John Bull, I forthwith essayed to sound the trumpet, and as we were then waging war against Russia, I blew my first blasts at the Admiralty and at the War-office. I feel bound to acknowledge that my communications met with very prompt and courteous attention in both those quarters, notwithstanding the pressure of the war on the time of our naval and military heads of departments, nor am I without good hopes that the results may, ere very long, prove important. But, although the superiority of these boats has never before, as far as I am aware, been thus publicly advocated in this country; yet, so far back as 1851, they did, on one somewhat remarkable occasion, attract the attention of some of our ablest naval officers. The occasion to which I allude was one that must be still fresh in the mind of every member of this Association, when, in consequence of the great loss of life that had occurred on our coasts from the upsetting of life-boats, his Grace the Duke of Northumberland made his munificent offer of 100 guineas for the best model of a life-boat which should be sent to the Admiralty Surveyor's Department, Somerset-house, by the 1st of January, 1850. In reporting the general results of the inquiries into the various qualities of the boats submitted to their inspection, the Northumberland Prize Committee expressed themselves as follows:—"Hitherto all our boats have been of wood, but the testimonials in favour of metal boats are very strong. Galvanized iron would be the most economical, and the corrugated form of it would give strength; but if metal boats be adopted, copper might be preferred, as more durable and more tractable. The boats in which Lieut. Lynch, of the United States Navy, descended the rapids of the Jordan, in 1848, were of copper, and that officer's report of them was favourable. It is said that a copper boat is now supplied to every vessel in the United States Revenue Service, if not to the Navy at large. The first cost of such boats might be heavy, but the material would be always of value. In metal boats it is affirmed that the air-tight cases could be more easily built in the boat, and kept from leaking."

The committee conclude their observations by recommending a full and fair trial of metal boats, at every convenient opportunity. Nevertheless, five years elapsed after that report was penned, during which, a subject so full of interest to a great commercial people was suffered to lie dormant, until now revived by a land-lubber like myself. But should I succeed in arousing the attention of the mercantile and shipping community to the subject, as I have already done that of our chief naval authorities, I shall feel amply rewarded for my trouble.

15. It is now time that I should attempt to describe, in detail, the remarkable features of this manufacture. The extraordinary powers derived from corrugated iron are pretty generally known. Here are two plates of the sheet iron, the one with a plain flat surface, the other with plain semicircular corrugations at intervals. Let each be placed in turn between two supports, so that each end may rest on one of the supports, and it will be found that whereas the one will bend in the middle with its own weight, the other will sustain a weight of 650 lbs. on its centre. Corrugated sheets of iron, as all of you

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[*] Major Eyre has presented to the Society a series of models illustrative of boats and waggons made on Mr. Francis's principle.

must be well aware, are now being extensively employed for roofing and other purposes in railway stations, and other large public buildings, but the simple corrugations required for such purposes are effected by a rapid and easy process, differing in some very essential respects from that required to give strength and stability to the graceful curved form of a boat. This can only be obtained from gradual pressure between two enormous dies, worked with all the force of the hydraulic press, the greatest force within certain limits that is ever employed in the service of man. The drawing before you represents the machinery invented by Mr. Francis for stamping his metallic boats. It represents the two enormous cast-iron dies already alluded to. These are equal in dimensions to a full-sized boat, with concave corrugations on the upper, and corresponding convex depressions on the lower, die. These dies are made to fit each other very exactly, and shut together by the force of the hydraulic pressure, and thin plates of metal being placed between them, are thus pressed into the form of a boat as the dies come together. The corrugations are imparted at the same time, (whereby the surplus metal, which would otherwise gather into wrinkles at the bow, is absorbed,) and a degree of stiffness is thereby given to the thin metallic sheets, rendering any ribs or bracings (such as are indispensable for a wooden boat) superfluous. The result is found to be a degree of strength and capability of resistance absolutely incredible until actually witnessed. To those so well skilled in mechanics as my present audience, it will at once be apparent how ingeniously and, at the same time, how perfectly Mr. Francis has here overcome a hitherto insuperable difficulty. This has been so clearly set forth by Colonel Portlock, of the Royal Engineers, in some remarks made by him on the occasion of his honouring my lecture at the U.S. Institution, that perhaps I cannot do better than quote his own words. In allusion to the corrugating principle he said, "Let it be considered what that principle is. By corrugating the iron, the flexible plate is rendered rigid as the surface is bent, so as to form longitudinally a series of parallel girders or beams, and transversely a series of arches: but it is also evident, that by thus rendering the plate rigid, the difficulty of adjusting it to a curve, or varying surface, is greatly increased, and, without doubt, that difficulty would have prevented its use in the construction of boats, had not Mr. Francis surmounted it by his ingenuity. He determined to give the rigidity due to corrugation, and the form of the boat itself, by one simultaneous operation, and for that purpose he prepared dies of the form of the boat, with grooves on the surface, corresponding to the intended corrugations, and the plain sheets being placed in the dies, and subjected to the powerful pressure of a hydraulic press, were at once corrugated and shaped. This very ingenious contrivance was not, however, even then quite perfect, as Mr. Francis soon found that the same breadth of metal being required to be adjusted to different spaces, the surfaces were wrinkled, or over-lapped the lesser spaces; but this difficulty he quickly overcame by adjusting the guage of the corrugation to the position of the plate, and thus, as it were, not only swallowing up the superfluous metal, but giving more strength to the parts requiring it. It is not wonderful, then, that the results proved satisfactory, and that Mr. Francis most fully carried out his object of providing the admirable ships' boats, of which the models are before us."

17. Full-sized boats of this construction have been twice subjected to very severe experiments by order of the Admiralty—first at Liverpool, in January, by Commander Bevis, R.N., and subsequently in June, in the Woolwich Dockyard. On both occasions the tests were such as not even the strongest wooden boat that was ever built could have sustained without going immediately to pieces. For instance, being manned by a full crew, they were rowed several times with full speed against the stone wall of the dock; they were tossed over and over with excessive violence on the stone pavement; they were filled with large blocks of stones placed amidship, and piled up to a considerable height, and then hoisted up by tackles, head and stern; they were battered on the sides with large hammers on one spot, with all the force a strong man could master; but all without producing the slightest injurious effect. At the end of all this rough treatment, they were found perfectly whole and water-tight.

18. For the ordinary or extraordinary wear and tear of sea service, the united testimony of all naval men, by whom they have been tried during the past eight years, proves satisfactorily, that these boats are possessed of all the qualities that are desirable, both as regards economy, durability, and safety. They are fire-proof, water-proof, worm-proof, incorrodible, liable neither to warp nor split; and yet stronger, lighter, more buoyant, and cheaper than those constructed of any other material. What more can be possibly desired in a boat? Even Mr. Ruskin ought to be satisfied that this is the very king of boats, although made of a material so abhorrent to his primæval taste as iron or copper. Still it can boast beyond all rivals of his favourite virtue—"it will keep out water." Thus, then, by this process, we have a light and strong metal boat—the advantages of which are well understood by all nautical and practical men, and it may be added, that if the weight of metal in a boat is reduced one-half by producing the strength in the sheet itself, instead of by adding timbers or frames to impart it, the cost is proportionately reduced. If a heavy wooden boat in the water strikes an object, such as a wreck, or a rock, the concussion, if severe, causes injury, if not destruction, whereas a light boat rebounds, and consequently is not injured.

This has been fully demonstrated in the United States Exploring Expedition to the Dead Sea, before alluded to. The navigation of the River Jordan involved no ordinary peril, and the boats were subjected to the severest possible tests and trials. They were impelled against rocks; they were dragged over shoals; they were swept down cataracts and cascades. The wooden boats which started with them soon went to pieces and were abandoned, but the metallic boat survived through the whole, and finally floated tranquilly in the heavy waters of the Dead Sea in nearly as good condition as when they first left the dies. I will not take up your time by reading at length Capt. Lynch's own testimonial on the subject. It fully confirms all I have said.

19. It is with feelings of real satisfaction that I am enabled to announce that these desirable boats will be no longer confined to America. Arrangements are now in progress for the immediate establishment of a large manufactory in London, and I hope eventually in Liverpool and Glasgow also.

20. It is a further gratification to state that, my operations in this country have been indirectly instrumental in bringing this subject to the notice of the Emperor Napoleon, whose eagle eye allows nothing that bids fair to benefit his country to escape him. In February last he personally examined into the merits of Mr. Francis's invention, and on the following day he thus promptly gave expression to his thoughts:—

"Palais du Tuilleries, 4th Feb. 1856.
"Cabinet de l'Empereur.

"Sir,—The Emperor has witnessed, with great interest, the experiments which have been made in the river Seine with the pontoon carriage of your invention. His Majesty has also taken pleasure in obtaining information in detail respecting the boat of corrugated metal which you have invented and constructed. The Emperor hopes that your invention may establish in France the foundation of a new branch of industry applicable to the public services for war and for the navy, as well as for the mercantile marine; and his Majesty has advised me to inform you that he will learn with pleasure your determination on this subject.

"I am happy in having to transmit to you the accompanying box, which the Emperor sends as a testimonial of his satisfaction.

"Accept the assurance of my distinguished sentiments.

"FAVE."

The box alluded to was of gold, set with diamonds, to the value of 200 guineas. I need scarcely say that his Majesty's suggestion has been acted upon, and measures are now in progress for the establishment in Paris of the new branch of industry suggested in the imperial letter.

20. I have now said all that seems necessary regarding the metallic boat. I will next hasten to describe the other inventions, of which the models are now before you, as briefly as possible. Here is a strange-looking affair, called the "Life Preserving Car," and most justly may it be so styled, for it has probably saved more lives than any other invention yet known. It is, you see, of metal, in form somewhat like a boat, but differing from a boat in being closed over by a convex deck, having a hatchway in the middle whereby the passengers are admitted to the dark but welcome "fireside of hope" within. On the occasion of a vessel being stranded, a communication is effected with the shore by means of the well-known mortar and apparatus, first invented by Capt. Manby. The car is then suspended on a hawser, and hauled by the crew from the shore to the ship, whence, after receiving its living freight, it is drawn back to land by the people there assembled. This process is repeated until every person on board the wreck is in safety. At the wreck of the *Ayrshire*, on the coast of New Jersey, in the midst of a violent snow storm, every soul on board, comprising *two hundred and one*—men, women, children, and infants, were drawn through a terrific foaming surf "dry and comfortable." This is but one instance out of many, and for this one invention the name of Joseph Francis deserves to be held in universal honour as a benefactor to his race.

21. One of these cars has been recently received in this country from New York, on trial, and I will read you a letter just received by me from Capt. Wood, R.N., Secretary of the Royal National Life-Boat Institute:—

"Royal National Life-Boat Institution,
"14, John-street, Adelphi, London,
"9th August, 1856.

"Dear Major Eyre,—I feel much satisfaction in being able to report favourably of the experimental trial of Mr. Francis' 'Life Car' at the N. Yarmouth Regatta on the 22nd ult.

"A rocket, with line attached, was thrown over a life-boat moored at about 120 yards from the beach, and a hawser having been carried out, the Car was hauled along it, between the boat and the shore, but floating in the water. Four stout boatmen and myself came ashore in it without experiencing any inconvenience, and subsequently as many as *ten* boys were shut in and hauled off to the life boat and ashore again, being about 3½ minutes within the car without the admission of fresh air. The water was smooth enough at the time, but it was considered that the advantage of the car over any of the ordinary open conveyances hitherto in use for similar service would have been much more apparent in heavy sea, from the violence of which the inmates of the car would be so effectually protected. Many persons present on the occasion had witnessed trials of the ordinary instruments in use, such as slings, seats, buoys, &c., but their general opinion was that the car is very superior to any of them. The apparatus was worked by the Coastguard in the presence of Capt. Murray, R.N., the Inspecting Commander of the Yarmouth District, whose opinion coincides with my own on the valuable character of the car as a means for conveying persons from a wrecked vessel to the shore.

"Faithfully yours,
"J. R. WOOD."

"Major Vincent Eyre., F.R.S., &c."

22. It is devoutly to be hoped that our whole line of coast may be supplied with these admirable cars as soon as practicable. This is not a matter in which the country would be justified in sleeping. A single glance at the Wreck Chart for 1855 tells a fearful tale, sufficient in itself to urge us to prompt action in a matter which at any time may become personally interesting to everyone of us. In exerting ourselves to save others, we may some day find that we have been instrumental in saving our own lives, or those of our nearest and dearest kinsfolk. Not that it is needful to advocate the measure on any such selfish grounds.

23. Having already occupied so much of your valuable time, I can only briefly draw your attention to the model of a metallic army waggon, and the accompanying drawings illustrative of the various uses to which it is applicable on service in the field, whether as a travelling communication, or commissiarat store cart on land, or as a floating raft on water; or, by further combination, as a temporary bridge across a river, where no better means are at hand. This waggon has been twice tested at Woolwich, by Colonel Tulloh, who has recommended it strongly to Lord Panmure for adoption. The subject is now before the Select Artillery Committee.

24. I am not singular in the belief that if introduced into our public service in India, this invention would prove of incalculable value. Sir George Pollock, Sir Frederic Abbott, Major-General Brooke, and other scientific Indian officers of established fame, have expressed a similar opinion. Sir G. Pollock, after personally testing the floating capability of those waggons when fully loaded, thus recorded his opinion of their merit:—"If I could have had the benefit of Mr. Francis' carts when I crossed the five rivers of the Punjaub, the soldiers would have been saved some days' hard labour. I was detained a day or two at each river; whereas, with this carriage I could have crossed each river in three or four hours without difficulty, and without fatiguing the troops." It must be allowed that Sir G. Pollock is about the very best authority on this subject that we could possibly have. We all know that, in 1842, the British Indian Government (then under the able presidency of the Earl of Ellenborough, being called on to avenge our losses and disasters in Affghanistan, selected Sir G. Pollock, of the Bengal Artillery, for the command of the army of invasion, and on this occasion he traversed and retraversed with that large army the country of the Punjaub, the land of the five great rivers, each ranging from 300 to 500 yards in width, and throughout those difficult operations Sir Frederick Abbott was his chief engineer. Those officers were, therefore, peculiarly well qualified to appreciate such an invention as that under consideration, for the safe and easy transit of armies across swollen streams and unfordable rivers has been acknowledged by all military writers to be one of the most formidable difficulties in war; hence, it may be assumed that whatever tends to facilitate that operation by the readiest means, is justly entitled to a most attentive consideration. General Brooke, a very able and scientific artillery officer, who commanded the Horse Artillery throughout the Sikh war, has likewise expressed a very strong opinion in favour of these metallic waggons. He writes:—

"London, July 22nd, 1856.

"Having given an attentive consideration to subjects brought under my notice, in a professional point of view, regarding the introduction of metallic waggons for military service, it appears to me that great advantage will be derived, in all countries, from their usage in transport of ordnance stores and commissariat stores, more especially with parks of artillery, to replace the clumsy carts hitherto used. retarding progress, and affording no aid in any other way than as a cart.

"Such a resource for crossing streams would have been invaluable to us in our field campaigns in their application to service for crossing the field artillery; and I make no doubt that experiment will show the value to be very great, both in respect to efficiency and economy.

"I shall expect that, if it be fairly tested, the principle may be found applicable also to the waggons attending on the pieces of a field battery, thus obtaining the command of its own means to pass over streams, instead of being dependent on the resources of the country, under delays, and often entire failure, as we have witnessed."

25. In conclusion, perhaps I cannot do better than quote another sentence from Colonel Portlock's address at the

United Service Institution:—"In fact," he said, "there is so much of practical ingenuity in Mr. Francis's inventions, that he sincerely hoped that the British Government, however habitually cautious it might be in admitting great military changes, would follow the example at once of the government of the United States, and of Napoleon III., by adopting in the army and navy both the boats and the waggons of Mr. Francis;" to which I heartily respond an "Amen," with the addition of "life cars" for our coasts. However that may be, it is certain that the governments of France, Belgium, and Russia have seriously directed their attention to the subject, and seem determined at no distant period to adopt these inventions in their naval and military systems. It is, therefore, high time for the British public to be up and stirring, that we be not left behind in the race of improvement.

Home Correspondence.

ABSORBING BORED WELLS.

Sir,—The very learned title given to a very common practice, took my attention away from the paper recently published in your *Journal* under the above heading, and I should, perhaps, never have understood the meaning of "Negative Artesian Wells," had not my eye caught the words, "as a Means of Draining Land."

I presume Dr. Bruckmann is unacquainted with the fact that the use of "swallow holes" is, and has been for many years, a frequent accessary to under-draining in this country, and that it is a practice very much to be condemned where the fall from the drained lands will admit of a quick and certain discharge without them. At page 17 of my paper on "Land Drainage and Drainage Systems," I mention that "in several parts of England advantage is taken of absorbent substrata by concentrating the under drains to sumpts, or holes, called 'swallow holes,' but this practice appears to be open to objection, in consequence of the frequency with which the drainage water will rise and cover the surface of the ground (*and destroy the crops growing there*) when the substratum refuses to absorb the water discharged from the drains with sufficient rapidity."

I have known swallow-holes resorted to in various parts of England—in Yorkshire, Lincolnshire, Essex, Hants, Surrey, Herts, and Oxfordshire, but they are not economical, except where there is an incapability of outfall.

I am, &c.,
J. BAILEY DENTON.

Stevenage, 16th August, 1856.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August* 15*th*, 1856.]

Dated 18*th July*, 1856.

1691. Etienne Mehrel, Paris—Improvements in hand planes.

Dated 23*rd July*, 1856.

1760. Samuel Frédéric Berthiez, No. 6, Red Lion-street, Borough—An improvement in engines to be worked by a new elastic fluid in substitution of steam generated out of water.

Dated 28*th July*, 1856.

1784. John Coplin, Falmouth—Improvements in ships' windlasses.
1785. George Ritchie, 3, Ponsonby-street, Pimlico—Improvements in the manufacture of boots and shoes from materials not hitherto used for that purpose.
1786. Henry Robinson, Settle, Yorkshire—Improvements in arrangements and mechanism for the conveyance or transport of loads or weights.
1788. William Edward Newton, 66, Chancery-lane—An improved instrument for taking altitudes. (A communication.)

Dated 29*th July*, 1856.

1790. Peter Joel Livsey, Manchester—Improvements in arrangements and mechanism for rotating and retaining the rollers of window blinds.
1794. William Edward Newton, 66, Chancery-lane—Certain improvements in the process of generating illuminating gas. (A communication.)
1796. George Davies, 1, Serle-street, Lincoln's-inn—An improved portable apparatus for copying letters and other manuscripts. (A communication.)

Dated 30*th July*, 1856.

1798. Felix Caron, Great Titchfield-street—Improvements in fastening the handles of door locks and door finger plates.
1799. Robert William Sievier, Upper Holloway—Improvements in preserving wood from decay and also from destruction by insects.
1800. Henri Evette, Lizieux, France—Improvements in looms for weaving.
1801. Julien Denis, Queenhithe—An improved gelatinous and economical soap. (A communication.)
1803. Lieut. Francis Constable Simons, Kensington—An improvement in rifling the barrels of fire-arms and ordnance.

Dated 31*st July*, 1856.

1804. Joseph Hopwood, Bolton-le-Moors, Lancaster—Improvements in machinery for measuring and folding fabrics.
1805. George Holcroft, Manchester, and Peter Johnson, Wigan—Improvements in the manufacture of cement, and in the application of a known material to cementing purposes.
1806. Lieut. John James Kerr, R.N., Twickenham—Improvements in the manufacture of cartridges for fire-arms.
1807. Constantine John Baptist Torassa, Genoa—Improvements in obtaining motive power by the aid of explosive gases.
1808. John Evans, Castleton, Pembroke—A progressive lever, by which is obtained an increase of power over the amount of power applied.
1809. William Edward Newton, 66, Chancery-lane—A new musical instrument, to be played by the agency of steam or highly compressed air. (A communication.)
1810. William Edward Newton, 66, Chancery-lane—A new or improved process for obtaining aluminum. (A communication.)
1811. Richard Archibald Brooman, 166, Fleet-street—An improvement in the construction of carriages and wagons. (A communication.)
1812. Richard Archibald Brooman, 166, Fleet-street—An improved augur or boring tool. (A communication.)
1813. Pierre Marie Joseph Chamblant, 36, Rue de Lancry, Paris—Improvements in the manufacture of glass.
1814. William Coltman, Leicester—Improvements in knitting machinery.
1815. Thomas Wicksteed, Coleman-street—Improvements in separating sewage and other matters from water or fluid mixed therewith.
1816. Thomas Routledge, 17, Gracechurch-street—Improvements in the manufacture of half stuff and paper.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1826. William Franklin Shaw, Massachusetts, U.S.—An improved burner or apparatus for the combustion of air and inflammable gas.—1st August, 1856.
1854. John Yuil Borland, Manchester—Improvements in machinery for preparing and spinning fibrous materials.—6th August, 1856.
1868. John Woodman, Manchester—An improved telegraph insulator.—8th August, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed August 15*th*, 1856.

403. Hyam Jacob Hyams.
407. Henry Hodgkinson.
413. Sylvester Emil Sichel.
414. Frederick Austin Spalding Witter.
415. William Henry Bowers.
440. Isaac Moll.
442. Jacques Henri Marie Maissiat.
462. James Edward Boyd.
466. Thomas Goode Messenger.
480. Charles Frederick Claus.
482. Charles Damas Auguste Joseph Planque.
490. James Steedman.
492. Philipp Schafer and Frederick Schafer.
506. Francis Prime Walker.
520. John Graham.
616. Charles Durand Gardissal.
660. John Bishop Hall.
682. Gustav Georg Anton Ludwig Michael Schelhorn.
764. Charles Durand Gardissal.
962. William Smith.
1082. Jonathan Amory.
1086. William Edward Newton.
1144. William Horatio Harfield.
1190. Richard Maxwell.
1306. James Edward McConnell.
1400. Constant Jouffroy Dumery.

Sealed August 19*th*, 1856.

424. Richard Laming.
426. William Muir.
428. William Lynn.
438. John Barsham.
448. William Clarke.
452. John Sharp Cromartie Heywood and George Lloyd.
464. John Kingsford Field and Charles Humfrey.
613. James Murdoch.
617. Charles Durand Gardissal.
730. Constant Jouffroy Dumery.
1313. Thomas William Willett.

Patents on which the Third Year's Stamp Duty has been Paid.

August 11*th*.

1906. Hesketh Hughes.

August 12*th*.

1903. John Henry Johnson.

August 13*th*.

1955. Frederick Osbourn.
1961. William Bettle.
2039. Gage Stickney.
2040. Gage Stickney.

August 14*th*.

1914. Edward Finch and Charles Lamport.
1921. John Heritage.

August 15*th*.

1924. Thomas Clark Ogden and William Gibson.
2104. John Wright Child and Robert Wilson.

August 16*th*.

1923. Felix Alexandre Victor Delarbre.
1927. George Leedham Fuller.

Journal of the Society of Arts.

FRIDAY, AUGUST 29, 1856.

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EXAMINATION OF CLASSES IN INSTITUTIONS.

The next Examinations will be held during the week commencing Monday, the 1st of June, 1857. The programme of subjects, with other particulars, will be published very shortly.

PRIZE ESSAY ON THE SMOKE NUISANCE.

With this week's *Journal* will be delivered to each member of the Society a copy of Mr. Charles Wye Williams' Essay "On the Smoke Nuisance," for which the Special Prize of a Gold Medal, (value twenty-five guineas,) was awarded by the Council.

DRAWING INSTRUMENTS.

The Council have given their approval to a Box of Drawing Instruments, manufactured and sold by Messrs. Parkes and Son, of Birmingham, at the price of 3s. London Agents, *Messrs. Heylin*, 28, Paternoster-row.

MR. ATHERTON'S PAPER ON MERCANTILE STEAM TRANSPORT ECONOMY.

Remarks by James R. Napier, Glasgow.

I quite agree with Mr. Atherton in regard to the indefiniteness of the term "horse-power," as at present used in steam-engine contracts, and in the desirableness of having a dynamical unit, or standard of power or work, legalised, as well for the purpose of buying and selling machines producing power, as for that of scientific comparison. The rule or formula established by James Watt, for the horse-power of condensing engines, was $\frac{P.V}{33,000}$ or $\frac{\text{foot lbs., per minute}}{33,000}$ = horse-power, where the pressure (P), and velocity (V), had either their *actual* values or fractional parts thereof. But at this present time, the pressure (P) is continued at what it was in the days of Watt, viz.—7lbs., no matter what the actual pressure may be now. And for the velocity (V) almost every engineer has a scale of his own, varying according to the length of stroke of the steam piston. Some assuming the velocities to vary as $\sqrt[2]{}$ of the length of stroke, others following the Admiralty rule for paddle engines assuming the velocities to vary as $\sqrt[3]{}$ of the length of stroke. All these assumptions, moreover, have no necessary connection with the results desired, nor with the actual results afterwards obtained, nor do they answer any better the purpose either of the buyer or seller. and all the use they subserve is to fix the size of the cylinder by the very round-about method of resolving an arithmetical or algebraical equation in which two of the three quantities, diameter, length of stroke, or velocity, and horse-power required to be known.

As the term horse-power applied to steam-engines was fixed by Watt at 33,000 lbs. raised one foot high per minute, and as this same value is used by the Americans, the French, the Germans, and, I presume, by all nations where the history of the steam-engine is known, I would be very sorry to recommend any change as to the use of the name in any other sense than as synonymous with 33,000 lbs. per minute. I see no objection, however, to the entire abolition of the term *Nominal* Horse Power, as it is of no use whatever to the engineer, as little to steam-engine owners, and deceitful to the public.

As I adhere to 33,000 lbs. per minute being received as a horse power, I would object to the 33,000 being altered into 132,000, or into any other figure, without at the same time changing the name into something altogether different from horse-power or marine horse-power. I would suggest that the power be expressed in foot lbs. alone, as this is a term already known to all scientific nations. Dividing by 100,000, as Mr. Atherton suggests, the result would be stated in millions of foot lbs. Thus the *Banshee* is, according to Mr. Atherton's work on steam-ship capability, 350 nominal horse-power, 1,752 horse-power of 33,000 foot lbs. = 58,816,000 foot lbs. or $58\frac{8}{10}$ million foot lbs.

As to the tonnage question, I feel I know very little about it, except that the present law is very complex, and certainly does not give what Mr. Atherton would like, viz.—the displacement.

That part of Mr. Atherton's paper concerning the comparison of vessels is very important. What other writers have called the efficiency, or the ratio of power expended to the work produced, is surely a subject which all shipowners ought to be acquainted with. The formula adopted by Mr. Atherton for the efficiency or dynamical duty of steam-ships is, I fear, too rough an approximation to be recommended for general adoption, especially when a more exact and equally simple formula is at hand, and the one also from which Mr. Atherton's adopted formula is no doubt deduced, viz.—$\frac{V^3 \text{ mid. section}}{\text{Ind. H. P.}} = C$. The power in similar vessels, I here take for granted, at present varies as the cube of the velocity. This, I believe, is nearly true, and ought to vary also directly as the immersed midship section. For similar vessels the midship section (m) no doubt varies as displacement $\frac{2}{3}$; but scarcely any two vessels are similar (in the mathematical sense of the term); nor is the same vessel similar to itself when the draft of water varies.

The following table, deduced from published statements of some of the ships of the Navy, and also from vessels built by the firm with which I am connected, shows the difficulty there would be in the use of the formula V^3 displacement $\frac{2}{3} = C$, from the displacement $\frac{2}{3}$ having no necessary connection with the midship section:—

Comparison between Midship Sections and (Displ.) $\frac{2}{3}$.

	Mid. Section.	Displ. $\frac{2}{3}$.	Mid. Sec. Dis. $\frac{2}{3}$.
Ajax	807	212.5	1000:263
Amphion	546	160.	1000:290
Arrogant	580	181.4	1000:318
Blenheim	738	198.2	1000:267
Dauntless	522	171.2	1000:328
Euphrates	570	179.25	1000:314
Hogue	820	215.	1000:261
Horatio	537	142.8	1000:266
Sans Pareil	920	229.8	1000:250
Simoom	567	198.18	1000:350
Termagant	587	179.4	1000:306
Black Swan	385	140.76	1000:366
London	233	86.89	1000:373
Lady Eglinton	207	77.33	1000:378
Queen	122	44.5	1000:365
Bogota (P) very deep	330	134.51	1000:408
Victoria (P)	47	25.	1000:532
Vulcan (P)	56	26.962	1000:481
Lancefield	244	draft. 96.8	1000:397
Fiery Cross	270	12.11 $\frac{2}{3}$ 100.2	1000:371
	331	14.11 $\frac{2}{3}$ 117.5	1000:355
	394	16.11 $\frac{2}{3}$ 135.08	1000:348

In the *Fiery Cross*, at different drafts of water, there is a difference of nearly 3 per cent. in the ratio of midship section to displacement $\frac{2}{3}$, which might affect the co-efficient C to the same extent.

The *Victoria* and *Vulcan* are two river steamers, of nearly the same size and power, yet there is upwards of 5 per cent. of difference in the ratio of midship section to displacement $\frac{2}{3}$. The formula used by Mr. Atherton is, notwithstanding these remarks, exceedingly useful for commencing the designs of steam vessels, and may be an approximation sufficiently near for most practical purposes.

In reference to the table of the performances of steamers, which I recently gave to Mr. Atherton, it is necessary to remark that too much confidence is not to be placed in it as an exact document. Though I aimed at the truth, it is possible I may have erred in the speed which is generally on the Clyde tried between the Clock and Cumbrae lighthouses, or 13⅔ nautical miles—too great a distance for maintaining a uniform speed, especially in new vessels, strange firemen, &c. I believe the statement, however, to be nearly true, and the study of it affords useful lessons. The last column shows the efficiency of the vessels by both formulas; I adhere, however, to the mid-section formula, as being the more correct.

The *Vulcan's* speed and power is deduced from a number of trials at a measured statute mile on the Garelock. The *Simoom's* performances I obtained from one of the dockyards.

The *Bogota*, a common paddle-wheel steamer, employed by the Pacific Steam Navigation Company, and loaded very deeply at her trial, shows a very inferior result to that of the screw steamer *Black Swan* (now *Ganges*), not deeply laden. Their displacements are nearly alike, and their speeds about equal; yet the paddle vessel (too deeply laden) requires about 60 per cent. more power than the screw.

The *London* and *Lady Eglinton* are two screw vessels, near enough alike to be comparable. The screws are the same diameter, but the one is more immersed than the other, which, I imagine, is sufficient to account for at least part of the difference in the efficiency of the two vessels.

The *Edina* was constructed by Messrs. Barclay and Curle, and her engines by Inglis; but I was kindly invited to the trial, and got the particulars of displacement, power, and mid-section from the constructors. The trials of the screw steamer *Lancefield* are not so satisfactory as could be desired, there being a little uncertainty as to speed. At the first trial the screw was not immersed: the result shows a very low co-efficient. The speed at the other trials is uncertain, as it was taken at sea, and not in the usual way for such calculations.

I was unfortunate in not getting the particulars of the power and speed of the *Persia* before she left the Clyde, so as to add her performances to the table.

To the President of Section G. on Mechanical Science.

Sir,—With reference to Mr. James R. Napier's remarks on my paper, "Mercantile Steam Transport Economy," I beg to submit the following observations:—Mr. J. R. Napier concurs with me as to the indefiniteness of the term "nominal horse-power" as at present applied in marine engineering practice, and in the desirableness of having the unit of power, denoted horse-power, specifically defined; and he prefers that the measure originally proposed and acted upon by Watt, viz., 33,000 lbs. weight raised one foot high per minute, be now adopted as the statute unit of horse-power.

On this point I have merely to remark that scientifically it is a matter of indifference what may be the statute measure of the unit, provided it be specific. In my essay on "Steam-Ship Capability," I based my calculations and tables on 132,000 lbs. raised one foot high per minute, because that was the average performance per nominal horse-power of the ten mail-packets then employed in H.M.S. In my paper on "Mercantile Steam Transport Economy," I have suggested that 100,000 lbs. raised one foot high per minute be adopted as the statute unit of horse-power, because that is, I believe, about the average present practice in the highest class of our merchant steam-shipping, and this measure of the unit would facilitate calculation; but whether 33,000 or 100,000, or 132,000, or any other number of lbs. weight raised one foot high per minute, be adopted as the statute unit of horse-power, is a mere matter of convenience, a question very proper for being submitted for the consideration and recommendation of a committee.

As to the question whether the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. H.P.}}$ or $\frac{V^3 \text{ Mid. Sec.}}{\text{Ind. H.P.}}$ would be the better formula for determining the relative dynamic merits of steam-ships, these formulæ are, as respects *similar* types of *immersed* form, a mere transformation of terms, for in similar types of form the immersed midship section will vary in the same proportion as the cube root of the square of the displacement. These formula would, therefore, give proportional results. I have, however, preferred the formula based on displacement $\left(\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. H.P.}}\right)$ because this formula may, as I believe, be made the base of calculations as to the capability of ships for mercantile service, for which purpose the formula based on midship section, without reference to displacement, is inadequate.

The table of data now supplied by Mr. J. R. Napier is a valuable addition to our statistical data, in so far that, after having determined the relative dynamic merits of the ships referred to, and classified them accordingly, the information afforded by this table will aid in the analysis of their respective types of form. I would, however, beg to suggest that the position of the centre of gravity of the immersed midship section of each ship expressed by its depth below the surface line at which the displacement has been calculated, would be a very important addition to this table, and it is hoped that Mr. James R. Napier will be able to supply it.

In fact, it is in consequence of the depth of the centre of gravity not being noticed in the formula above referred to, that I have spoken of it in my paper as "open to criticism," and probable amendment, and I shall be prepared, in committee, to submit this view of the case for consideration. Requesting that this letter be read conjointly with Mr. Napier's remarks,

I am, &c.,
CHAS. ATHERTON.

DECIMAL COINAGE.

On the occasion of the adjourned discussion held on the 23rd of July, on Professor De Morgan's lecture on this subject, Mr. Robert Slater, jun., made some remarks in reply, of which the following is the substance:—

The silence of the "tenpenny men" at the meeting held by the Decimal Association at the rooms of the Society of Arts, on the 16th of this month, did not arise from any doubts of the scheme we have suggested, or from any convictions wrought in our minds by the arguments Professor De Morgan employed on that occasion, but we were indisposed to risk placing ourselves in the invidious position in which Mr. Minasi considered himself placed when he attended the meeting first held on this subject at the London Tavern. We felt we had not been recognised by the Decimal Association, who had ignored the "tenpenny men" in recapitulating the various plans proposed.

When we contrast our position with that of the £-and-mil plan, I think we have no cause to regret the comparison. The "tenpenny men" have forced themselves into their position from the practicability of their views, whilst, on the Professor's own admission, the Decimal Association has been struggling, or, at least, the advocates of that scheme have been struggling, since 1816, and to our minds, that plan is as far from the goal now as when it was first started; and we arrive at that conclusion because, for various reasons, we regard the scheme as impracticable. On one point this opinion is shared by its advocates in common with us. They feel that their system wants commensurability with our existing coins, and have devised various plans to overcome that difficulty.

At one time there was to be an arbitrary declaration by government, giving the value of four mils to an ordinary penny, and five mils to the broad-rimmed penny, but this soon fell to the ground. Now we have this notable scheme of tacking on a farthing to the sixpence, which we hold to be doing an injustice, or, as the Professor very rightly termed it in his lecture, a "robbery." I am glad it is admitted as a robbery, but, at the same time, I cannot approve of the qualification the Professor has chosen to place upon it. He said it would be only "a very small robbery," which reminds me of the anecdote of the frail spinster, who, when accused of having had a child, retorted that it was "only a very little one." I think this bantling of the Decimal Association, if only a very small one, equally illegitimate, but it will grow to the dimensions of a giant. Professor De Morgan proposes that sixpence should be current for six pence in copper and a farthing. Of course a shilling will be current for twice as much in copper, that is, 12½d., the florin for 25d., and the pound for 250d. We "tenpenny men" are anxious to have a coin representing 250 copper pence, but we can have it without doing injustice to any one.

Mr. Minasi, in his letter, has said that our views have been misrepresented in respect to the concurrent circulation of our existing with the tenpenny coins, the franc and its multiples, on which point Professor De Morgan anticipates great difficulties. Now, we apprehend no greater difficulty than at present exists in the concurrent circulation of threepenny and fourpenny pieces, or half-crowns and florins, and we should not complicate matters by introducing two coins of the same value of different sizes, as is the case with the florins.

The climax of Professor De Morgan's arguments against the "tenpenny men" was, that he would be glad to see how they would approach the pay-table. The Professor stated in his lecture that he was manager of a Savings Bank, and had to pay and receive large amounts weekly in silver. If I might venture to give my advice upon this matter, speaking from practical experience, I would recommend that the silver should not be kept in the bulk, but, as received, it should be counted, and the several descriptions of pieces kept separate. This is always done by bankers' clerks, who mark the contents of each package of silver; they have also a separate bowl with a small quantity of mixed coin, and thus it is easy to pay away large amounts in silver.

We were asked how we would pay 17s. 6d. to the workman for his week's wages. We should give him seven half-crowns if we had them, and if we had only tenpennies we should give him 21. The workman would very soon understand that a half-crown contains three tenpennies; he would combine the two together, and would thus experience no difficulty in finding that the amount if paid in a mixture of coins was correct.

But, suppose he had to receive 17s. 6d. by the £-and-mil system. The master would give him 17s. in silver, and as copper would be thrust upon him under the plan proposed, he would give him the sixpence in copper. The receiver says, "I must have my additional farthing." The master replies, "I have no farthings; here is a sovereign, give me the change," and when the man tendered two shillings in silver, and sixpence in copper, the same squabble would arise again over the farthing. Either the master or the workman must lose it. If the master loses it, it would involve the necessity of having an immense number of farthings to meet all these odd payments.

But, suppose the man had five days' wages to receive. That would be 14s. 7d. of our present currency. In that there would be no difficulty under the tenpenny plan, but the amount could not be paid by the £-and-mil system, whilst there would still be the squabble over the sixpence, and another with regard to the fraction of the penny.

If the shilling is not to have the same effect in its relation to copper, an agio would be introduced upon a particular class of coins, which would be destructive of any decimal system.

But take the £-and-mil scheme further. Supposing a merchant to pay his clerk a month's salary at the rate of £100 a year. Under the Professor's scheme it cannot be paid exactly. The nearest approximate to it is paid, and at the end of twelve months the man finds he has received a trifle less than £100. A month's wages at the rate of £100 per annum, would be £8 6s. 8d.; by the tenpenny plan the exact amount may be paid. The merchant, in posting the transaction in his ledger by £ s. d., or by the tenpenny, would require only three figures, whilst by the £-and-mil, four figures would be necessary, increasing his labour 33⅓rd per cent. Mr. Minasi, by his table,* has established the fact that, by the tenpenny plan amounts can be expressed in figures less by from 4½ to 9 per cent., than by the £-and-mil scheme, and in a trifle less than by the exisiting plan. The National Debt has been cited as an instance against us on this point. I do not know how it stands at the present time, but on the 5th of May, 1846, it amounted to £785,053,022 8s. 3¾d., and the annual charge to £28,125,534 10s. 6d. Thus, under the existing system, the £-and-mil and the tenpenny plans, the amount is expressed by 13, 12, and 13 figures respectively,—whilst the charge is expressed by 11, 11, and 10 figures respectively.

I further object to the £-and-mil scheme, because it would affect nearly all existing contracts between a halfpenny and fourteen or fifteen shillings or more, in which odd pence are involved. As these are matters of exact computation, they would require to be exactly expressed, or else there would be a loss sustained, or a "robbery" committed, if this scheme were adopted, because, under the £-and-mil scheme, you cannot exactly express any amount used in the present coinage except even shillings and sixpences.

But one of the greatest objections we have to the £ is, the fact of its being so high a unit, that, in order to work calculations of small values, a multiplicity of figures must be introduced. This has been alluded to fully in the book published by my father, and as the Professor has referred to that book, and appears to be acquainted with it, and yet in his lecture passed this point by in silence, I take it that the arguments there used are unanswerable by the £-and-mil party.

To take a simple example, however, exhibiting this difficulty, look at the case of the workman with 17s. 6d. a week. When he takes his money he has to convert it into mils. Tacking on the odd farthing got out of his master, he finds he has 876 mils, and is astonished at the large amount he has to dispose of. In the abstract it seems so large that he can hardly conceive he will be able to spend it. By and bye his landlord comes for 125 mils for rent —half-a-crown a week—then he goes to provide his Sunday's dinner, and finds dealers vend their wares by 33's, or 45's, or 57's, whereas they are now calculated by 8d., 10d., or 14d., and odd halfpence, which he can grasp readily in his mind. Having been subjected to so much mental exertion in the market he finds some refreshment necessary. He meets a friend, and invites him to have a pot of beer; but as they cannot settle the decimal question so soon as the beer, they order another pint. The man has been in the habit of getting beer at 2d. per pint, and foolishly imagines that his three pints will be paid for by six copper penny-pieces. But the landlord says, "I do my business in mils now; my beer is 9 mils a pint, that's 27 mils for three pints, which require seven 4-mil pieces less a farthing;" and the man finds he has lost not only the farthing gained from his master, but two others to boot. That would not be calculated, I think, to reconcile him to the £-and-mil system.

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* *Journal of the Society of Arts*, Oct. 5th, 1855.

The views which the tenpenny men entertain upon the system of decimal coinage, are to a great measure shared in by the advocates of the International Decimal Association, who, it appears, desire to introduce the French system in its entirety. We do not, however, wish to do that. By the tenpenny plan, we should be able to calculate exchanges in many instances by a per centage, as the French now do with the Belgians. They say, for instance, the exchange between Paris and Antwerp is ¾ths or ⅞ths per cent., as the case may be. We have never stated that we look upon our tenpenny as the exact equivalent of the franc, because we do not propose to alter the standard of value either in gold or silver, which the International Association must do, if they would introduce the French system as it stands. We would maintain our standards of gold and silver in their integrity, and any charge against us of wishing to alter the standards is not correct. The only alteration that was proposed before the International Association arose, was on the part of the £-and-mil people.*

The £-and-mil scheme would not facilitate intercourse with foreign countries in matters of exchange. In some instances it would throw difficulties in the way. In the case of a country using dollars, and where we quote the exchange in pence, and go so low as one-eighth of a penny, this scheme is incapable of showing the nice distinctions which could be shown by the tenpenny system, which admits of such quotations being made as they now are. The general language of persons using coin under the tenpenny system would be identical with that at present in use, because, until we arrive at an amount of two shillings or more, the prices of articles are quoted in pence.

The observations I have made may be said to be the general opinions of our party,—but there are some points which we have not yet quite matured. We are not prepared to say at present how long we should require the exisiting coins to remain in circulation. We lay down broad principles for guidance, and leave it to the people to fix the details, and the mode of carrying the thing out as is most convenient to them. Some of us would be glad to see a decimal coinage immediately instituted with tenpence as the integer; others of us say, do not introduce decimal coinage based either upon the penny or the pound, unless you decimalise weights and measures at the same time. I may state that we are not at present prepared to recommend a plan with regard to weights and measures, nor are we prepared to adopt the French system, because we think that the majority of contracts are not founded on French weights and measures, but that English weights and measures carry the preponderance over those of the French in the commerce of the world at large. A reason for disapproving a decimal system of coinage alone is, that there are many principles in the existing system of our weights and measures which we consider desirable. There are many absurd differences, both of nomenclature and value, that we cannot approve of, and should be glad to see swept off, but we admire the principles involved in the subdivisions of the cardinal weights and measures, which a decimal system does not possess to nearly the same extent, and there are certain ratios between our weights and measures, and between the weights and measures and the coinage, which I consider most convenient for purposes of calculation; indeed, mental calculation can be carried on by the existing system to a large extent by a simple process, which under any decimal system would not be possible. The £-and-mil scheme would entail a vast increase of labour over the existing system, and even over the tenpenny system, because large quantities have to be resolved into small values for the purpose of being retailed amongst consumers, therefore, our system should be one capable of subdivision to the utmost extent.

I would, in closing, refer to the terms of the circular by which the meeting was convened. We were invited to hear a lecture "Upon the Present Position of the Decimal Coinage Question." During the week which has elapsed since that was delivered, there must have been some great change wrought, for the card calling the adjourned meeting alludes to it as a lecture "On the Approaching Simplification of the Coinage." Now I believe the witnesses called, up to the present time, by the Commissioners who have the matter in hand, have been generally opposed to the £-and-mil scheme, and therefore I can only imagine that the arguments used by these parties have worked so powerfully on the minds of the Commissioners, that they see that the penny cannot be done away with, and that they must adopt the tenpenny system, since the talk is of the simplification of the coinage. I should rejoice at that, were our weights and measures at the same time decimalised, but under any circumstances should regret the adoption of the £-and-mil scheme, and I think the country at large would be equally dissatisfied with it.

MEANS FOR PREVENTING THE FLY FROM DESTROYING THE TURNIP PLANT.

By Charles Poppy, Ipswich.

From the great loss of plant of turnips last year, and general destruction of turnips this year,—so similar to what occurred from 1825 to 1833, and I believe onwards, and which has taken place periodically for several following years—I am led to publish the following observations on the subject, although I am quite aware of the difficulty of the subject from past experience, having had a correspondence with the Secretary of the Society of Arts, upwards of thirty years since, which continued for a year and half, as is reported in the "Transactions" of the Society, vol. 45, pages 11 and 54, in 1827.

The Doncaster Report on the Turnip Fly, published in 1834, consisted of 89 pages. I can, however, but briefly enter upon the subject; thus my observations will chiefly relate to the remedies proposed within the power of farmers individually to apply, and suggest a *probable* means of so reducing the flies as to render them harmless, by a systematic application.

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* This was questioned at the meeting by the £-and-mil advocates when Mr. Slater read from page 59 of the *Decimal Association Proceedings*—"Gold, our only legal standard of value, is inevitably the sole basis or starting point of our monetary system; and though other metals can and do serve for small change or as tokens, it is convenient that authorised subdivisions of the pound sterling should, like itself, signify so much gold; *i.e.* corresponding proportions of the sovereign in weight, even though they be not so represented in actual gold coins. I have worked out a system which by slightly modifying the assay, standard, or quality of our gold coin (*i.e.* altering its *gross* weight while preserving its actual *net* weight in fine gold, as by law established), many important desiderata may be at once secured."—*Mr. Franklin.*

From the loss of the first plant of turnips, all farm-work is thrown in arrear; re-ploughing and sowing, and hay-harvest at the same time to attend to; no turnips fit to hoe when the hay is stored. If the second sowing take, the turnips are not fit to hoe till corn harvest begins.

Mr. Blake, agent to Sir J. H. Palmer, Bart., Rockingham, says:—"Never lost a plant; attribute this to *drilling thick*. Plants draw each other up." C. Barnet, Esq., Stratton-park, Northamptonshire, says:—"Sows *thick in the drills;* though the flies make a severe attack, they will turn out a good crop." Mr. Slater, Stratton, near Cirencester, Gloucester, says:—"Bid defiance to the fly by sowing eight or ten pounds of seed per acre." —*Extracts from Doncaster Agricultural Association Report.*

Mr. Taylor, late of Ditchingham, near Bungay, Norfolk, and Mr. John Hayward, of Stoke-hall, near Eye, Suffolk, both "broad-casted very thick, and cut the turnips into rows with the horse-hoe, and always succeeded in obtaining a plant." Mr. Taylor and Mr. Hayward both occupied good turnip land farms, or I doubt whether a plant could have *always* been obtained in defiance of fly, if *broad-casted, unless excessively* thick.

Many of the correspondents of the Doncaster Association state, that by sprinkling lime over the turnip plants *several times*, they commonly obtained a plant of turnips; others state that soot is preferable to lime, as it manures as well as annoys the fly.

One watered a field five times at a cost of fifteen shillings per acre, and saved a plant; water obtained at both ends of the field.

I could greatly increase this list of specifics, having selected the most popular only; but I believe, from upwards of thirty years' practice, that a more certain mode of obtaining a plant exists, *which is less expensive, and applicable under any circumstances, drilling or broad-casting, on the ridge, or on the stetch*, highly manured or not, as far *as the fly is concerned.*

The mode and means of obtaining a plant of Swedes might be stated in few words, but to induce farmers to try it, the reason why it may *rationally be supposed that it will prevent the fly from destroying or injuring the turnip plant, and that it is but a trifling expense, and little trouble, must be explained, and facts stated.*

Having hired a heavy land farm, bounded on two sides by extensive woods, in which I was informed by the late Rev. Wm. Kirby (the eminent Entomologist), that "all the turnip flies in the neighbourhood hybernated during the winter." After ascertaining that such was the fact, I decided to give up attempting to grow swedes, as I had *rarely obtained a good plant*, and frequently had to sow a second time, and I did not always succeed then.

It was by accident that I ascertained that the fly preferred the common turnip. Mr. Kirby had informed me of the nature and habits of the fly, "that they could fly as well as the golden beetles, or any of that tribe of insects, and that it was useless for me to persevere to grow swedes, as none of my neighbours grew them, and common turnips were not required to be sown till long after swedes, and thus *all the flies existing in the neighbourhood were drawn on my swedes.*

Thinking that if such was the fact it might *enable me to grow swedes, instead of preventing my being able to obtain a plant*, being aware that Mr. Paul of Starston was in the habit of sowing decoys for the flies, and catching them off with a net, I took my drill to a clean fallow field lying along the side of a wood, and drilled one width of the drill across the middle of it, being twenty rods probably from the wood. As soon as the turnips were up, flies attacked them, but being *very thick* the turnips kept growing. Having given the flies time to collect, I had a waggon load of haulm taken to the field; this I had spread over the turnips and along the sides as far as flies leap; and having plenty of help, set fire to it from end to end and burnt up the turnips, and as I supposed, all the flies which had existed in the woods and neighbourhood; but on sowing the field with turnips, others came and destroyed the plant.

Thus at the proper season for sowing common turnips (having plenty of swede seed, and having an iron barrel to my drill, with cups of all sizes on blocks which could be slipped on; and having adopted the general opinion that the fly preferred the swede to the common turnip), I filled every alternate hopper of the drill with common turnip and swede, and thus drilled probably more than half a peck of *swede seed per acre*, at 15 inches from row to row. But to my surprise the fly settled on the white turnips, and scarcely touched the swedes. Finding this, I had the swedes chopped into patches, and, when an inch or two high, had a pinch plucked out of every bunch of swedes, and when a little more grown I had another portion plucked out from each patch, and then left till fit for singling. By this means I got a regular plant and fair crop, considering that it was late for swedes.

Having ascertained that the fly prefers the common turnip to the swede, I drilled white turnips in alternate rows in future (*very thick, to feed the flies*) and swede seed for a crop, and never failed to obtain a plant after.

After having adopted drilling common turnip seed in alternate rows, with swede-seed intended for a crop, some years, a small farm fell under my care where the bailiff said swedes could not be grown, as the fly would destroy the plant. I however decided to try to grow swedes, and having steeped common turnip seed in water to cause it to vegetate before the swedes were up, and having primed the drill with swede and common turnip seed, I sent it off to the farm, and followed myself. After having seen a few bouts drilled, I left. As soon as I was gone the bailiff stopped the tunnels that distributed the common turnip seed, "to ascertain what difference it could make"—a good plant, and excellent crop was grown.

This circumstance showed that it was not necessary to drill decoys at such narrow intervals, and in future the furrows only were sown with white turnips, and I never missed getting a plant of swedes.*

I left off *drilling decoys* on my own farm also, and only sowed furrows *excessively thick* four or five stetches distance (more or less according to soil or weather), and still never failed of obtaining plant.

In 1825 I entered into a correspondence with the Secretary of the Society of Arts on the subject, which continued for a year and a half, when the Society awarded me a Gold Ceres Medal.

They had it tried in the neighbourhood of Blandford, Dorsetshire, as stated in the Report of the Transactions of the Society for 1827, page 12 of preface. It is stated that the result of this "was the only good crop of *turnips obtained during the last year* (1826) *in that part of the country.*" 1826 happened to be the most *general* destructive fly year recorded, or my system would have had no effect, and would have been thought to be as useless as numbers of other modes which had been thought to have been a means of saving crops from the attacks of the fly.

Mr. Spence, chairman of the Entomological Society (being on a visit to Mr. Kirby), called on me to inquire about the mode I had adopted, and seemed not to doubt but it was adapted to protect the swedes.

Sir John Sinclair had a copy of the account of it, published by the Society of Arts, inserted in an Edinburgh paper, and had copies of it struck off to distribute in Scotland, and sent me a large packet to distribute, and it led to a long correspondence between us.

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* As this farm was within a mile of Ipswich, a turnpike-road on one side of the field, and a riding way through, where the farmers frequently rode, I took care to drill the decoy rows thick enough to supply the flies.

If any one should be induced to try the decoy systems I have described, they should continue to use the same means to obtain a plant they now pursue, *until they are convinced of its being a protection from the attack of the fly.*

Many farmers doubt the probability of a few rows of turnips or mustard, being *drilled thick*, protecting a crop. There are few farmers who have not seen where a drill coulter has been stopped and the seed accumulated till the obstruction broke away and scattered the seed very thick for a rod or two, that when the plants over a large field have been swept off by the fly, the thickly drilled has withstood the attack of all the flies long after the crop was destroyed. It is the same if seed is spilled *in some measure*, but nothing like the *drilled*. Another circumstance relating to the fly question may not have occurred to the reader of this treatise. By an experiment, turnip seed sown and covered with garden mould four inches, on the fourth day had shot forth a radicle two inches long, and a germ one inch.

Thus the root reached *from the surface* six inches, while the germ was then *three inches* under the surface, and at *the same ratio*, in four days more, the root would have reached eight inches from the surface, while the germ would yet be two inches under the surface. If the root cannot penetrate the land to that depth, the fibres spread, but under the above circumstances the bottom of the root is not parched up, if parching weather occur, it is delving into a moister soil, the lower and lower it descends, and when the germ appears above ground, it is far more able to withstand an attack of the fly and put forth leaves.

Another portion of the seed was sown and covered one-inch deep with mould; this had shot forth a radicle one-and-a-half inch deep in four days, and a germ half an inch; thus in the same ratio, within four days more, the germ would have reached the surface when the radical had reached but four inches in depth, and not reached below the influence of parching winds, and the plants would not be able to withstand the attack of fly, and if no fly exist, would grow slow and weak, and be very slow in coming to the hoe.—*See Potts' Cyclopædia.* We must take extremes to show effects. Four inches seem too deep to deposit turnip seed, and one inch is evidently too fleet, except on favourable soils or moist weather, and it is only by using a drill that turnip seed can be deposited at a proper depth according to soil and weather. A few years after I had used wide intervals for decoys, I drilled a small space with turnips early to try the effect of different manures. The flies soon infested them, but having sown two acres of mustard in an adjoining field, *the flies left the turnips and settled on the mustard*, and there remained till it was harvested, ascending as the bottom leaves withered; thus I ascertained that the flies preferred mustard to common turnips, and I feasted them afterwards by sowing mustard for decoys. Mustard grows more rapidly than turnips, and can bear an attack of the fly better, not being affected by drought and piercing winds. The seed is commonly cheaper, and I have found it equally adapted to decoy the flies. I sowed it for decoys for the *first sown common turnips*, unless it was in a wet season, when there was no fear of fly. In two instances my decoys of mustard saved my turnips from being destroyed by black caterpillar (larva of the saw fly), and when my neighbours' turnips were so infested that they employed women and children to gather them off, I had none on my turnips.

I continued to sow decoys during upwards of thirty years, and never failed in obtaining a plant, although after finding this a certain mode of obtaining a plant in spite of the fly, I reduced the quantity of seed I had drilled from a quarter of a peck to a pint. This mode cost less, and I grew my decoy seed from untransplanted roots—seeds of selected and transplanted roots produced smaller tops and roots, and thus the plants were less able to stand an attack of the fly.*

The Rev. Mr. Berry, Pershore, stated that, "having cleared a piece of rough land, and planted it with hops and intermediate rows of cabbages, the cabbages became covered, and ultimately destroyed by turnip flies; and having consumed the cabbages, they attacked the hops and destroyed them."

From these circumstances it appears that if a small space was sown (or better, if drilled) with mustard some time, and the longer the better, before turnips were sown, few flies would infest the turnips. Such a space might be sown where white turnips were intended to be sown, and when the land was wanted the mustard might be mowed and ploughed in, and it would be worth as much as the seed cost, as manure.

As millions of turnip flies may be drawn to a decoy, it is evident they might be so thinned as to do no serious injury to the turnip crop, at a trifling expense, if this mode was extensively adopted. It is useless for a farmer or two to do so, as other swarms of flies would come.†

One breadth of a drill, drilled a few rods in length, will draw all the flies existing near by; it should be drilled so thick *that the plants draw each other up*, and a heavy roll passed over two or three times must surely destroy all the flies. This cannot be doubted, if the space is ploughed and a heavy roll passed over it, it *must destroy them*. A small garden patch of turnip seed will supply enough for decoys, and, as it does not require transplanting, costs little. The same is true of mustard seed, and it is not subject to blight or to be injured by birds.

I am led to publish this treatise from the turnip fly abounding in this neighbourhood, so that many have had two sowings swept off, and one only that I have heard of not having one sowing destroyed, with a prospect of failing to obtain a plant from a second or third seeding.

Turnip flies abound periodically, and when they do, they abound for several following years commonly. They so destroyed the crops from 1824 to 1833, that the Doncaster Agricultural Association distributed circulars over England and Scotland, requesting information on the nature and habits of the turnip fly; and received 102 returns, but with little practical information; it was too expensive and did not meet every circumstance.

To sow turnips *very* early to be in time to sow a second time in case the fly destroy the plant, frequently causes a loss by cost of seed and labour. If the first sown escape the fly, it is very liable to mildew, and to be of inferior quality; and if the fly attack the first sown, waiting to ascertain whether a sufficient plant will survive may prevent sowing a second time till it is too late to get a good crop. The reason a second sowing generally survives an attack of the fly, (if the land is reploughed), is because it has laid a length of time without being stirred, and has gained moisture; such will be the case if left untilled for a time, and unsown till the proper time for sowing, according to soil and weather.

A seed merchant (a correspondent of the Doncaster

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* Having two acres of turnip seed—when it was cut, an immense number of turnip flies settled on some rows of cabbages growing alongside of it—I had not observed the flies on the seed. There were four acres of young swede turnips growing in the same field, yet the flies remained on the cabbages in a dull state, not leaping when disturbed, but tumbling on the ground.

† Mr. Chas. Neal, Mansfield, Notts, says, "In 1826—had a field of nine acres sown the first week in June with rape. In a few days after, the plants were covered with flies. The field admitting of irrigation, water flowed over it for three hours, and the destruction of thousands of flies witnessed; but the very next day the plants were completely covered with fly, and it ended in the total destruction of the crop."—*Doncaster Report.* "In 1786, one hundred thousand pounds were lost by the destruction of the turnip crop in Devonshire by the fly."—A. Young's *Annual.*

Agricultural Association) stated that "those who sowed early were his best customers." The question to be considered is whether it is less expense to sow decoys during two or three years when no injury would have occurred from the attack of the fly, or to lose a plant, and have to plough and re-sow the land once in two or three years. It is not whether the plant is destroyed only, but whether it is jagged, stunted, and retarded in its growth, and a long time in coming to the hoe.

When the cause of smut and earcockle in wheat became generally known, a remedy was soon found. And as the larvæ of the wheat-midge fall to the ground, when the milk of the kernel is consumed, where a crop is much injured the land ought to be thinly skimmed, raked, and burned. "The turnip fly never injured the crop the following year."—*Doncaster Report.*

Science must discover the cause of agricultural pests, but accidental circumstances more commonly lead to the discovery of remedies.

The certain mode of obtaining a decoy to protect the crop, is, to drill *one row of mustard on the stetch* between the crop plant, or if thick enough, every three or four stetches is sufficient. I state this because I see furrows sown where no mould exists, slaky and cloddy, and of course no manure!

If any one fail to protect their crop, I believe it must be from mismanagement.

Summary.

The first warm weather in the spring revives the turnip fly from its dormant state, and it issues forth from its hiding place in search of food, and returns to sheltered places at night.

In May and onwards through the summer the fly continues, day and night, on whatever food it has settled on, till rape or turnips are above ground. Their being able to fly may be ascertained by putting in rows of turnips *thickly* with the hoe *in the middle of a field.*

Whether the fly has a choice of food may be ascertained by putting in rows of mustard, rape, common turnips, and swede, at a little distance from each other. And this will show whether the flies can be destroyed—when disturbed they leap a few inches only; thus a heavy roll, or being covered by the plough, must kill them, or haulm or straw scattered over them, and set fire to, will singe their wings.

REPORT OF THE PATENT LAW COMMITTEE OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Made 12th August, 1856.

At the meeting of the British Association held in Glasgow (September, 1855), a Committee, consisting of the Earl of Harrowby, the Duke of Argyll, Sir David Brewster, W. Fairbairn, Thomas Graham, Col. Sabine, and Thomas Webster, was appointed, on the recommendation of the Mechanical Section, "for the purpose of taking such steps as may be necessary to render the patent system of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors, and the advancement of practical science."

This Committee, after reviewing the position of the question, in reference, not only to the report of their immediate predecessors, the Committee appointed at the Liverpool meeting of the British Association, but to the proceedings at former meetings of the Association, and of other parties, at the Society of Arts, the Manchester Committee (presided over by your Vice-President, Mr. Fairbairn), and the United Inventors' Association, and the powers existing under the "Patent Law Amendment Act of 1852," presented the following Memorial to the Lord Chancellor:—

"*To the Right Honourable the Lord Cranworth, Lord High Chancellor of Great Britain.*

"The undersigned members of a Committee of the British Association for the Advancement of Science beg leave to present the following statement to your Lordship.

"The amendment of the patent laws, and the encouragement to be thereby afforded to practical science, has from time to time occupied the attention of the British Association for the Advancement of Science. At the meeting of the Association in Glasgow, in September last, the following resolution was passed:—

"'That the Earl of Harrowby, his Grace the Duke of Argyll, Sir David Brewster, Colonel Sabine, the Master of the Mint (T. Graham), William Fairbairn, and Thomas Webster, be a Committee for the purpose of taking such steps as may be necessary to render the patent system of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors and the advancement of practical science.'

"At the meeting of the British Association at Liverpool, in the preceding year, a similar resolution was passed, appointing a Committee, also presided over by the Earl of Harrowby.

"The report of that Committee to the meeting of the Association at Glasgow, and the proceedings thereon, are sent herewith.

"In that report, and in the discussion to which that report and another communication on the patent laws gave rise, at the Glasgow meeting of the British Association, attention was directed to various defects in the present system, all, or nearly all of which had been the subject of evidence before, and of consideration by, the Select Committee of the House of Lords, in 1851, on the Patent Bills of that session. These defects were intended to be provided for by the 'Patent Law Amendment Act, 1852,' establishing the present system, and it is believed that the greater part of them are capable of being dealt with by a liberal interpretation and administration of the powers of that Act.

"The first section of that Act provides that the Lord Chancellor, the Master of the Rolls, and the law officers for England, Scotland, and Ireland respectively, together with such other person or persons as may be from time to time appointed by her Majesty, shall be 'Commissioners of Patents for Inventions.'

"The first report of the Commissioners of Patents contains the following passage:—'The law officers of Scottand and Ireland not being in England at the commencement of the Act, took no part in the proceedings (*i.e.* of bringing the Act into operation), and as the functions of those officers, in respect of patents for inventions, are entirely abolished, it is not to be supposed that they (the law officers of Scotland and Ireland) will be called upon at any future time to act as Commissioners.'

"In reference to the result of this interpretation of, and proceedings under, the Act, and of the non-appointment of any other person or persons as a Commissioner or as Commissioners for the administration of the new system, the report of the Liverpool Committee says:—'That system has been so arranged as to exclude the law officers of Scotland and Ireland from its administration, and to devolve the responsibility on the Lord Chancellor, the Master of the Rolls, and the Attorney and Solicitor-General of England, whose other official duties are so numerous and engrossing as to prohibit their affording that attention to the development of a system confessedly so difficult as to be incapable of adequate administration without the co-operation of persons practically acquainted with the requirements of the system intended to be established, and for the establishment of which ample provision and powers are contained in the Act.'

"The Committee of the British Association, having regard to the inherent difficulty of the subject, and to the number of questions, either of administration or of legislation, adverted to in the accompanying report, and at the Glasgow meeting of the British Association, respectfully suggest that her Majesty should be advised to appoint some other persons as Commissioners of Patents under the 'Patent Law Amendment Act, 1852,' or that the working of that Act should be the subject of immediate inquiry.

"(Signed)
HARROWBY.
ARGYLL.
EDWARD SABINE.
THOMAS GRAHAM.
WILLIAM FAIRBAIRN.
THOMAS WEBSTER.

"London, March 11, 1856."

The Lord Chancellor has recently expressed, through the Earl of Harrowby, a willingness to comply with the prayer of the memorial, on being distinctly informed and satisfied as to what such Commissioners would be expected to and could do; to this the Committee of last year have not had the opportunity of making any reply, but they are encouraged by various circumstances to believe that these and similar efforts, if persevered in, will not be in vain, and that the reform of the patents, which in the first address of your first president, the Rev. Vernon Harcourt, was pointed out as one of the subjects to which a scientific Association might be justly expected to call public attention, and which has repeatedly been brought before your meetings, will ere long be recorded as one of the many results of the British Association.

A discussion then took place, in which Messrs. W. Grove, Q.C., Wm. Fairbairn, and others took part, and on the motion of Thomas Webster, seconded by P. Le Neve Foster, the following resolution was passed—"That the Earl of Harrowby, Lord Stanley, M.P., James Heywood, M.P., The Master of the Mint (T. Graham), Wm. Fairbairn, General Sabine, and Thomas Webster, be a Committee for the purpose of taking such steps as may be necessary to render the patent system of this country and the funds derived from inventors more efficient and available for the reward of meritorious inventors and the advancement of practical science."

INTERNATIONAL PHILANTHROPIC CONGRESS AT BRUSSELS.

The Congress will be opened on the 15th of September next, and its sittings will be held in the hall of the Royal Academy of Sciences. No one can be admitted without a ticket. The tickets may be obtained on application, on and after Sept. 12, between the hours of 10 o'clock and 4, at No. 22, Rue des Arts, Quartier Leopold.

The questions to be submitted to the consideration of the Congress have been divided into the three following sections:—

Section 1.—Supply of provisions in relation to agriculture.

This will include all questions which refer to the prevention of the evils resulting from short leases, an unequal balance in the agricultural labour market, or unfair taxation. The best means of extending the principles of association and insurance, and encouraging the improvement and cultivation of waste lands, together with the cheap transport of produce, drainage, manure, the breeding of cattle, the establishment of model farms, agricultural schools and museums, and the publication of statistics of produce in various countries.

Section 2.—The supply of provisions viewed in relation to political economy and philanthropy.

This embraces the consideration of free trade in food and all necessaries, and the means of lessening those taxes which have a tendency to raise the prices of these commodities.

The best method of arranging markets, the regulation of weights, measures, and coinage, and the establishment of a strict supervision over articles of food, for the prevention of their sale in an unwholesome state, will come under discussion. The advantages of the spread of sound doctrines of political economy, and the publication of correct trade statistics, will also be noticed. The judicious encouragement of importation, with special reference to the large quantities of cattle in America and other countries, the extension of fisheries, and the occasional purchase by the government of foreign produce for the supply of the army and other public establishments, so as to avoid producing a scarcity in the home markets; the checking the distillation of alimentary substances, both as diminishing the supply of food and as promoting drunkenness and crime; savings' banks, benefit societies, and other institutions for promoting the encouragement of habits of prudence and foresight among the working classes; the regulation of emigration, and the possibility of establishing a permanent commission in each country to follow up the purposes of the Congress; these and other kindred subjects will form the business of this section.

Section 3.—Scientific and mechanical processes connected with the supply of provisions, the means of facilitating and improving hand-labour, and of diminishing the danger and unhealthiness of certain trades, together with the improvement of the dwellings, furniture, and clothing of the working classes.

Among the most important subjects which will occupy the attention of this section, may be enumerated the following:—

The application of science to increase the production and improve the quality of various alimentary substances; the introduction of new sources of food, and the substitution in those processes in which edible substances are employed (such as distillation, &c.), of others not suitable for food; the modes of preserving food; the prevention of every kind of adulteration; the improvement of all the various processes employed in the making of bread; the increasing the healthiness of certain trades, and the prevention of accidents to which workmen are liable; the general amelioration of the condition of the workman, both as to lodging and clothing.

With reference to the question of the adulteration of bread, it is submitted that it is very undesirable to sanction the mixing of any other substance with the pure flour, as likely to afford facilities for fraud and misrepresentation.

Various suggestions as to the best means of preventing the sale of unwholesome or adulterated food, either by constant inspection or otherwise, as well as the principles on which penal laws should be framed for this purpose, will be brought under discussion.

The best modes of preparing food so as to economise its nutritive qualities, and of preserving it for the purposes of importation from parts of the world where it is very abundant, are questions of much weight.

The limitation of the hours of labour for women and children, the regulation of the age at which the latter are to be allowed to work, and the prohibition of their employment in occupations unsuited to their strength, are also questions of importance, as well as the ventilation and warming of work-rooms.

With reference to the interesting question of the improvement of the dwellings of the working classes, the formation of building companies where the shareholders would understand that a high interest for their capital was not to be expected, but that the object in view was a philanthropic one, is particularly recommended for consideration, while, on the other hand, the absolute prohibition of the use of any dwellings known to be unhealthy, will also be advocated. It is also suggested that architects might be appointed to superintend gratuitously the erection of houses for the poor, and that plans and drawings of dwellings found to be most suitable might be published and circulated.

The furniture, clothing, and, in short, everything relating to the domestic life of the workman, is capable of much improvement, and the formation of permanent Economic Museums is recommended, in which would be collected such specimens and models as would convey a knowledge of the articles best suited by their utility, durability, and cheapness, for the workman's domestic use. These institutions would thus afford him the advantage of comparing the articles manufactured in various countries, and of choosing those which appear to him most adapted to his wants.

In addition to the above-mentioned questions, the Congress will discuss the best means of rendering their deliberations really useful, and of extending and giving stability to their efforts, particularly in the following respects:—

1. The establishment of international correspondence on the principles laid down at the Philanthropic Congress at Paris.
2. The publication of a periodical notice of the various works and documents which refer to the proposed objects.
3. The establishment, in different countries, of a *Permanent Economic Museum*.
4. The arrangement of the time and place for their next meeting.

After the preliminary business of the Congress is concluded, it will probably be thought desirable at the first general sitting, to bring under its notice the most recent measures taken in various countries, both for preventing and moderating sudden deficiencies in the supply of food, and for the general improvement of the condition of the working classes.

Finally, the third section, which members of other sections will be at liberty to attend, will draw up a special report on the Economic Exhibition, so as to bring into notice those articles which may be most useful in reference to the objects of the Congress.

At the opening of each sitting, one of the secretaries will declare what publications or communications of any kind, relative to the subjects discussed, have been presented to the Congress, and the documents will be published either at length or in an abridged form, according to circumstances, in the printed report of the proceedings of the Congress, a copy of which will be sent to each of the members.

LAND DRAINAGE IN FRANCE.

The law which places at the disposal of French agriculture the sum of 100 million francs by way of loan, for promoting drainage, has been passed by the Legislative Body. The Count de Bryas, the Reporter in reference to this law, has once more shown the various benefits which this new and important discovery will confer upon those countries which adopt it on a large scale.

The report presented to the Legislative Body contains a statistical *resumé* on the importance of agriculture in general, and especially on the cultivation of wheat, which, it is believed, will be found useful for consultation. It carefully points out the permanent danger likely to accrue from insufficient harvests.

This leads to the important question of corn generally, and the imperative necessity of no longer leaving to chance and carelessness so important a matter as the food of the people. Viewing the subject in this aspect, it will be useful to quote at length from the report:—

"Agriculture in France holds the first place in the production of national wealth; it employs 25 million hands, and produces in value, every year, upwards of 90,000 millions of francs. This immense mass of produce, in which wheat figures to the amount of 1,400 million francs, is, nevertheless, not sufficient to prevent the country from going abroad to make up the necessary supply of grain.

"On striking a balance from 1815 to 1847, between the imports of wheat, amounting, in round numbers, to 50 million hectolitres, and the exports, amounting to 25 millions, it is plain that the production of the country shews a deficit on the whole, and that it has been necessary, on the average, since 1815, to import into France, annually, 900,000 hectolitres of wheat, representing a value of from 15 to 20 million francs, if the purchases were made at ordinary prices. Unfortunately the deficit does not occur with this annual regularity, and the danger consists in the uncertain intervals at which these insufficient harvests recur. There were upwards of 8 million hectolitres required in 1832, 1846, 1853, and 1854. On such occasions the prices rose immoderately; thus, in 1817, the average price of importation was 36 fr. 16 cent. the hectolitre, and in 1847 it rose to 56 francs. At other times the excess of the harvest did not allow of importation. We were able to export to England, in 1848, of wheat and flour, to the value of 30 million francs; in 1849, 43 million francs; in 1850, 60 million francs, and in 1851, 70 million francs. Unfortunately, looking carefully into the matter, we find that the prices of exportation did not repay the cost of cultivation; in reality, we exported at low prices, and obtained from abroad what was wanted at high prices, causing enormous sacrifices, amounting to 300 million francs for the year 1847 alone. Official statistics show, that altogether, from 1815 to 1847, a period of 32 years, we have obtained from abroad 144 days' subsistence, at a cost of 10,000 million francs, or at the rate of from 6 to 7 millions for every 24 hours.—(Moreau de Jonnés *Statistique de France*, p. 127.)

"In France, the cultivation of wheat extends over about 20 million hectares of our best land. Annually, six millions of hectares are under wheat cultivation, producing on an average 12 hectolitres the hectare, making about 72 million hectolitres. This rate of produce is distributed very unequally; some special hectares producing 40 hectolitres, others only six or seven. The general average in the department du Nord is 21 hectolitres, in the department du Lot it is much below seven. According to the opinion of men best qualified by practical experience in drainage matters, it is calculated that there are six million hectares of land under wheat cultivation which are capable of being drained with advantage. These figures are below those of our colleague, Mons. Gareau, given in his report on the Drainage Law of 1854; they scarcely come up to the calculations of Mons. Herve-Mangon, as shown in his "*Etudes sur la Législation anglaise*;" whilst they agree exactly with the calculations of Mons. Barral in his "*Traités de Drainage*."

"According to the most moderate supposition, the law now under consideration will promote the application of drainage to two million hectares, representing one-third only of the arable land which is capable of deriving sure benefits from it. Wheat will cover every year 500,000 hectares of those lands, upon the supposition of a four-course shift, as generally adopted in France.

"All agriculturists and economists agree to estimate the increased value of the harvests that would arise from drainage, especially in wet seasons, at eight hectolitres the hectare. Distributed over 500,000 hectares, this increase amounts to four million hectolitres. The influence of four million hectolitres on the wheat harvests of France, turning the scale of our markets precisely at those times which would otherwise have been times of scarcity, will be immense. We shall find in this resource a guarantee against fluctuations in prices; we shall diminish the anxieties and sufferings of the masses produced by dearth of food. Such periods of dearth, you are well aware, produce at times the most serious political embarrassments, and place our public finances in a critical condition. If this be so, are we not right in saying, it is a question of national importance."

THE PUBLIC HEALTH.

The Registrar General, in his report last week, says:—

"These diseases (zymotic diseases, and diseases of the respiratory organs and consumption) are natural to man, but their ravages are greatly aggravated by the physical impurities of the atmosphere, seen from a distance hanging in a cloud over London.

"The smoke of our manufactories has been rendered less dense than it was by Lord Palmerston's Act. It will ascend as dark as ever in winter from the fires of 340,000 houses; but Dr. Arnott has shown that the evil may be greatly diminished, and by the mere modification of lighting the fire from the top much of the smoke is burnt.

"The dust of the principal streets, which are now covered with horse dung, watered every day, and beat up by omnibuses, may be got rid of by frequent cleansing and by new processes. The railways which traverse the southern, the eastern, and the northern parts of London would, if extended to the centre and the west, not only relieve the thickest thoroughfares, but facilitate the movements and the traffic of the population, dwelling in houses which it was computed at the last census could be all visited by going over something more than 6,563 miles of ground.

"The third class of atmospheric impurities is invisible, but it arises from the long retention of the excrement of London under the houses and in the sewers. According to the estimate of Mr. Lawes, London could supply the farmers of England daily with 29 tons of ammonia, 51 tons of carbon, 14 tons of phosphates, 32 tons of mineral matter, and 14 tons of other matter, making in the aggregate 140 tons of dry manure, dissolved naturally in about 19 times its weight of water. The country requires this precious manure, which London is anxious to get rid of at any reasonable cost, as it is now known to be as insalubrious as it is offensive.

"The problem for the engineer to solve is, how can 3,000 tons of town guano be returned daily to the disinfecting soil, from which it was chiefly taken, with the least offence to health, and with the least cost? Shall it be distributed by pipes, or by railways? Shall it be disinfected by water, earth, ashes, or any chemical compound?

"Under the present arrangements some hundreds of thousands of tons of this matter lie in store in London, putrifying in cesspools and percolating the streets, while the residue is thrown into the Thames at a great cost.

"All these impurities of the air we breathe in London have evidently a natural tendency to increase more rapidly than the population, and can only be removed by the vigilance, intelligence, and energy of the Boards of Works.

"Every substantial sanitary improvement they effect will be as evident as the diminution in the mortality of the districts which now receive a purer water, and which will, it may be expected, ere long receive it on the system of constant supply."

Home Correspondence.

EXAMINATION.

Sir,—No act of the Society of Arts is more likely to tell upon the education of the artisan than the resolution which has been so vigorously adopted and carried out during the last few weeks. In the absence of any public system of secondary education, such as the continental governments have instituted, there has been hitherto no encouragement to the boy who has left the elementary school, to carry forward or to preserve the little knowledge that he possesses. I cannot, however, but lament that the advantage to be held out should be restricted to members of Mechanics' Institutes. If the Society would affiliate elementary schools, or, at least, *commercial* and *trade* schools, a great inducement would at once be held out to parents to keep their children longer at school, and a corresponding impulse would be given to *night schools*, in which boys removed to work might still prosecute their studies. Night schools, as a whole, I take it are a failure. To serve a substantial purpose they should supply the want of *Ecoles de Dessin* and other institutions of secondary education in France and other countries, for want of which our own country will soon be left behind in the markets of the world. The Society of Arts has taken the initiative in supplying that radical defect, but her leverage will be immensely increased if she would extend her patronage to all schools which profess to instruct the pupils in those principles of science that enter into the everyday work of our operatives.

I have under my care an elementary school and a higher school. Promising boys may be promoted from the lower to the higher without additional payment. All I want is the opportunity of sending up the best pupils to the examinations of the Society of Arts, and so of rendering them eligible to situations of trust, in order to open out the most encouraging prospect of promotion to a boy of real talent, though he belongs to the lowest condition of life.

By an extension of privilege, such as I have proposed, it appears to me that a great stimulus would be applied to popular education, while the chartered object of the Society of Arts would be directly promoted—the progress of arts, manufactures, and commerce throughout the land.

I am, &c.,
C. H. BROMBY.

Cheltenham, August 26th, 1856.

Proceedings of Institutions.

Greenwich.—The Society for the Acquisition and Diffusion of Useful Knowledge held their usual half-yearly general meeting of the members at the lecture-hall on Tuesday evening, the 29th of July, when the respective reports of the auditors, trustees, and committee were submitted, and the various officers chosen for the next six months. Mr. William Morris presided. Mr. Bass, the Hon. Secretary, read the report of the Committee, from which the following extracts are made:—"The receipts for the past half-year, including members subscriptions, sale of catalogues and newspapers, library fines, &c., have been £219 8s. 8d., and the expenditure for newspapers, books, lecturers, printing, salaries, &c., £214 6s. 3d., leaving a balance in the treasurer's hands of £5 2s. 5d. In the trustees' report, we find that £293 3s. 2d. has been received during the past half-year for hire of hall and the various class and school rooms, including donations of £5 15s., and the expenditure for interest on loans, local rates, and building account, amounts to £289 3s., leaving a balance in hand of £4 0s. 2d. The total debt now chargeable on the property of the society amounts to £6,265 19s. 10d. The present number of members is not, of course, quite so large as in the winter of the year; nevertheless, 670 adults and 140 minors paid their subscriptions last quarter, and 100 new members have joined the society since the commencement of the present quarter. An increasing number of books are taken out of the library, quarter after quarter. 3,238 volumes were read last February, being an increase of 21 over the February of the preceding year; 2,487 were issued last May, this number being greater by 53 than that taken out in the May of the previous year. Your committee are pleased again to report that, notwithstanding this large issue, it was found at the half-yearly examination of the books, held in March last, that not a single volume was missing. * * * * The Committee have received from the Astronomer Royal a very beautiful engraving on steel of the planet Saturn, as seen in a Newtonian telescope of ten feet focal length, drawn by Warren de la Rue, Esq., F.R.S. The engraving is considered by astronomers as conveying a perfect idea of the appearance of the planet in the year 1852, the systems of rings, both illuminated and obscure, being well delineated. * * * * The committee have bestowed considerable care in the preparation of the new lecture list. * * * * The committee direct attention to the result of the examination of the members of the Mechanics' and Literary Institutions of England, conducted by gentlemen of the highest eminence, selected by the Council of the Society of Arts. * * * * There were fifty-two candidates for examination, and so remarkable was the proficiency of some of them in the subjects in which they were examined, that it called forth expressions of astonishment as well as admiration from the learned examiners. Some of these gentlemen said that in the experience of their lives, although they had been engaged in some of the best educational establishments of the country, they had never known examination papers answered so elaborately and so well as they had been in this examination of the members of our Literary and Scientific Institutions. The Greenwich Society has reason to be proud of the result of this examination. Three of its members eminently distinguished themselves—Mr. James Scotson obtained the ten guinea prize and a certificate of excellence for chemistry—he had also awarded to him a certificate of proficiency in mechanics; Mr. James Spencer obtained the ten-guinea prize and the certificate of excellence in English History—he had also awarded to him a certificate of proficiency in English literature; Mr. James Ware obtained two certificates of competency in mathematics and geography, a certificate of proficiency in English literature, and a certificate of excellence in English history. Your committee do not think it out of place to mention that the youngest candidate for examination, a youth named Alfred Lister, between 13 and 14 years of age, who was sent up from the Leeds Institution by a grant from the committee accorded to him in admiration of his talent and his application, obtained a first-class certificate in mathematics, and that Mr. William Matthew Taylor, a member of the Windsor and Eton Literary and Scientific Institution, obtained the Society of Arts' prize of twenty-five guineas for general excellence in the examinations, he having obtained three certificates of the highest grade in mathematics, geography, and English literature. The Society of Arts have also recommended to the Inland Revenue Office for government appointments, two of the young men examined, viz., Robert Abbott and Charles Chambers, both of the Leeds Mechanics' Institution. Your committee are very much pleased that these examinations have been instituted, and at their results. Their tendency will be to make the Institutions of a more thoroughly educational character than they have hitherto been. It is very delightful to find that they are now supplying so many persons from one end of England to the other with a means of spending their leisure time pleasurably and profitably; that books which "soothe, and cheer, and elevate" are taken by tens of thousands from their libraries, and that their lectures are furnishing so much instruction and amusement to the many who hear them; but it is of the first importance that the young mind should be educated; that it should be supplied with useful knowledge and strengthened by a judicious exercise of its higher faculties; that it should be prepared for the efforts it will have to make in this world, and encouraged to make them; that it should feel that its labours will not be useless nor unregarded, but that it is watched by those who are anxious to foster its development and prepare the way for its reward. Your committee hope that you will not lose sight of what the Society of Arts is doing for these Institutions; that you will, by the formation of classes, co-operate with them in their praiseworthy endeavours to make them more truly useful than they have hitherto been, and that at the examination of next year, this Society will distinguish itself even more than it has done at that which has just concluded. * * * * Your committee, in conclusion, congratulate you upon the present condition of the Society. There are but very few which maintain their numbers so steadily as it does. They are pleased that it manifests no signs of decay; they would be better pleased if it kept advancing, increasing its numbers, and consequently extending its usefulness. They believe that it and all kindred Institutions must advance, as their influence is more generally and more correctly understood, and as men become more anxious for the mental, moral, and social improvement of their fellow-creatures." Mr. G. W. BENNETT, in moving that the report be received and adopted, said he did so with much pleasure, for two reasons; in the first place, because it was now certain that the Institution was in a perfectly satisfactory condition, both with respect to the number of members, and as to its finances; and next because he could see in the report a prospect of a still more satisfactory nature. Institutions of this description had been hitherto, perhaps, too much devoted to mere amusement (not that he objected to amusement, for that, among a hard-worked population, was indispensably necessary), but because he believed it was most desirable that instruction, more particularly that sort which would enable a working man to earn his daily bread more easily, should be combined with it. He most positively believed that this would be the result of the examinations now established through the instrumentality of the Society of Arts. It was well that working men should be taught to look forward to something more than mere daily drudgery; that they should be convinced that by extra exertion they could raise themselves above their ordinary station; that the only limit to their position in life, was that which would be fixed by their own intellectual acquirements. This was true equality, for although politics were excluded here, he could not help saying, that after all, mental acquirements would so far secure the position of their owner, that mental and political position would be the same. His friend, Mr. Glaisher, had told him that the answers from those working men, even on abstruse questions, were such as to startle him; that they were such as he would scarcely have expected from University students. This was most encouraging, and would teach them that societies of this description had only just reached the most important phase of their career. They were now most truly becoming the schools of the people. With these observations he now begged to move the above resolution. The report was unanimously received and ordered to be entered on the minutes.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August* 15*th and* 22*nd*, 1856.]

Dated 1*st August*, 1856.

1817. William Paton, Springvale, Glasgow—Improvements in railway wheels.
1818. Alexandre Tolhausen, 7, Duke-street, Adelphi—A new and improved flexible pocket-umbrella, being likewise applicable to common and other sticks, canes, &c. (A communication.)
1819. John Watkins Brett, Hanover-square—Improvements in letter and numeral printing electric telegraphs.
1820. William Wood, Monkhill, near Pontefract, and Matthew Smith, Heywood, Lancaster—Improvements in looms for weaving terry and cut pile fabrics.
1821. William Wood, Monkhill, near Pontefract, and Matthew Smith, Heywood, Lancaster—Improvements in apparatus for cutting the wires out of terry fabrics.
1823. Eugene Perré Chevalier, Brussels—Improvements in the manufacture of cigars.
1824. Richard Albert Tilghman, Philadelphia, U.S.—Improvements in hydro-extractors or centrifugal machines.
1825. Robert Reeves, Bratton Westbury, Wilts—Improvements in machinery for sowing or depositing seeds and manure.

Dated 2nd August, 1856.

1827. Oliver Long, Cornhill—Improvements in mechanical knife-cleaners.

1829. Thomas Donkin, Bermondsey—Improvements in the glazing of paper. (A communication.)

1831. Thomas Green, Leeds—Improvements in mowing machinery.

Dated 4th August, 1856.

1833. Charles Gustavus Gottgetreu, 41, Charterhouse-square—Lithographic printing in oil and varnish colours and metal on glass, wood, papier maché, marble, metal, porcelain, or any other material that offers a suitable service.

1834. Nicolas Cadiat, 12, Rue de l'Odéon, Paris—The application of centrifugal force for purifying liquids.

1835. Charles Théodule Launay and Jules Chopin, Paris—Improvements in increasing the illuminating power of gas.

1836. George Walker and James Scrimgeour, Belfast—Improvements in spinning frames.

1837. Thomas Barnabas Daft, Dublin—Improvements in the manufacture of cast-iron pipes.

1838. Alexander Wright, Millbank-street, Westminster—Improvements in lighting mines and subterranean places with gas.

1839. Josiah Firth, Heckmondwike, Yorkshire, and Joseph Crabtree, Mill-bridge, near Heckmondwike—Weaving Scotch, Kidderminster, and Dutch carpets by means of a power loom.

Dated 5th August, 1856.

1840. Henry Walker Wood, Briton Ferry, Glamorganshire—Further improvements in the manufacture of fuel, and for a new mode of preserving coal and coke and other fuel.

1841. James Benjamin Bowen, Chipping Norton—Improvements in the manufacture of gloves.

1842. Charles Frederic Vasserot, 45, Essex-street, Strand—Improvements in machinery for cutting nuts, screws, and pieces of polygonal shape. (A communication.)

1843. Thomas Maples, Derby—Improvements in corn mills.

1844. Antoine Dominique Sisco, Paris—Improvements in railway brakes.

1845. Andrew Smith and William Smith, Mauchline, Ayr, N.B.—Improvements in ruling or delineating ornamental figures.

1846. Jean Jacques Danduran, 13, Charlotte-street, Fitzroy-square—An apparatus called the self-swimmer.

1847. Edwin Blomeley, Fernhill Mill, Bury—Improvements in the manufacture of fabrics applicable to various purposes for which airproof and waterproof fabrics are usually employed.

1848. John Keith, Eltham, Kent—Improved machinery for making envelopes. (A communication.)

1849. Alfred Vincent Newton, 66, Chancery-lane—An improvement in primers for fire-arm cartridges. (A communication.)

1850. Augustus Pfaltz, Massachusetts—A new and useful mode or process for making soap from rosin.

1851. Joseph Auguste Monnier, Marseilles—Improvements in transmitting motive power.

Dated 6th August, 1856.

1852. Alfred Mitchell, Liverpool—Improvements in apparatus for exhibiting and distributing advertisements, and for like purposes.

1853. George Holworthy Palmer, Adelaide-road, Haverstock-hill—Improvements in furnaces for generating heat.

1855. William Watt, Belfast—Improvements in treating or preparing Indian corn and other grain for fermentation and distillation.

1856. Thomas Evans, junr., Belmont-terrace, Lewisham-road—Improvements in harness.

1857. William Hall, Elisha Wylde, and William Waite, Birmingham—Improvements in steam-engines.

1859. James Farrar, Bury, and Henry Spencer, Rochdale—Improvements in apparatus for regulating the pressure and flow of gaseous liquids.

Dated 6th August, 1856.

1860. Lionel Weber, Bruxelles, Belgium—A combination applicable to keys of door-locks to prevent their being opened by pliers or other instruments from the outside.

1862. William Green, York-street, City-road—Improvements in the manufacture or production of fabrics and surfaces in imitation of, and as substitutes for, leather for bookbinding and other uses, and in machinery or apparatus for effecting the same.

1864. Coleman Defries, Houndsditch—Improvements in the roof lamps of railway carriages.

Dated 8th August, 1856.

1866. Robert Davenport, 12, Jonathan-street, Vauxhall—Certain improvements in kilns for burning pottery, earthenware, china, porcelain, and similar substances, to enable them to consume their own smoke.

1870. William Gorse, Birmingham—A new or improved door fastener. (A communication.)

1872. John Stephens, Suffolk-place, Westminster—An improvement in pipes for smoking.

Dated 9th August, 1856.

1876. Thomas Whittaker, Accrington—Improvements in the mode or method of washing or cleansing woven fabrics.

1878. John Darlington, 36, Cannon-street—Improvements in superheating steam. (A communication.)

1880. Chapman March, Alwalton Mills, Huntingdonshire—Improvements in propelling and working ships and vessels.

1882. Edward Owen, Aberdeen-terrace, Blackheath—Improvements in the manufacture of gas, and in the obtainment of products arising in such manufacture.

Dated 11th August, 1856.

1884. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—A new electro-motive engine. (A communication.)

1886. Alexander Symons, George-street, Mansion-house, and Edward Burgess, Clerkenwell-green—Improvements in noctuarys or tell-tales for ascertaining the fidelity of watchmen and for other purposes, and in the application of electricity to such apparatus.

Dated 12th August, 1856.

1888. Nicholas Doran Maillard, Dublin—An improved mechanical and magnetic compass.

1890. Edwin Firth, Flush Mills, Hickmondwike, near Leeds—Improvements in finishing mohair cloth.

1892. William Henry Brown, Albion Iron and Steel Works, Sheffield—Improvements in steam hammers.

Dated 13th August, 1856.

1894. David Lesser, Manchester—Certain improvements in machinery or apparatus for making "lozenges," or other similar articles.

1896. William Church and Henry Whiting Hamlyn, Birmingham—An improved method or improved methods of constructing or building hay and other ricks.

Dated 14th August, 1856.

1898. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of artificial stone and building and paving materials. (A communication.)

1900. Alfred Priest and William Woolnough, Kingston-on-Thames—Improvements in horse-hoes.

1902. Thomas Bilbe, Nelson Dock, Rotherhithe—Improvements in the construction of ships and other vessels.

1904. James Bannehr, 11, Bedford-circus, Exeter—Improvements in the manufacture of name and sign plates, boards and slabs, door and house numbers, street names, tomb stones and monumental slabs, and inscriptions, by substituting earthenware or porcelain, instead of the materials now in use for the above-named articles.

1906. John Goddard, 29, Moss-row, Bagslate, near Rochdale, and George Hulme, 4, George-street, Rochdale—Improvements in carding engines for the more speedy and effectual doffing or stripping of the cotton, woollen, silk, or other fibrous substances therefrom.

WEEKLY LIST OF PATENTS SEALED.

Sealed August 20th, 1856.

425. Thomas Smith and Joseph Gill.
463. David Jones.
471. William Sangster.
475. Bennett Johns Heywood.
487. Samuel Henn and Thomas Haddon.
508. John Smith.
522. Foster Connor.
542. John Aspinall.
544. John Venables.
598. Edmund Alfred Pontifex.
630. Henry Bessemer.
1004. Thomas Walker.
1268. Alfred Vincent Newton.
1342. Archibald Sinclair.
1356. Adam Stamm.
1410. Hector Grand de Chateauneuf.
1478. John Taylor.

Sealed August 26th, 1856.

288. Robert Barrow.
509. Isaac Westhorp.
513. Elisha Thomas Archer.
523. Charles Barlow.
524. William Allen Turner.
538. Robert Maynard.
543. John Edward Hodges.
545. John Edward Hodges.
568. John William Scott.
593. Henry Horner and Richard Bagley.
615. Prosper Pimont.
618 Phillip Marcus.
619. William Yates.
622. Charles Coates.
625. Edwin Thomas Wright.
659. Alfred Vincent Newton.
1023. Samuel Dyer.
1227. Charles Dewick, senr.
1241. Frederick Peter Dimpfel.
1373. Thomas Skaife.
1543. George Harvey and Alexander Harvey, junr.
1561. Alfred Vincent Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

August 18th.

1942. Charles Watt and Hugh Burgess.

August 19th.

1949. Alexander Cuninghame.
1977. William Austin.

August 21st.

1982. Eugène De Varroc.

August 22nd.

1959. James Webster.
1963. John Whiteley.
1973. Alfred Swonnell.
2022. William Beckett Johnson.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3868	Aug. 19.	Button, and fastening for the same.........	Wm. Thistlewood	Birmingham.
3869	Aug. 26.	Buckle	John and Daniel Holloway ...	Birmingham.
3870	Aug. 27.	Candle Lamp	Price's Patent Candle Company (Limited)	Belmont, Vauxhall.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 5, 1856.

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EXEMPTION OF INSTITUTIONS FROM RATING.

The following Bill [as amended in Committee] to "amend the Act 6 and 7 Vict., c. 36, to exempt from county, borough, parochial, and other local rates, land and buildings occupied by Scientific or Literary Societies," is now printed, with a view to elicit the opinions and views of the Institutions thereon, in order that the Council may take steps for getting the Bill introduced into Parliament in the next Session in as complete a form as may be.

Whereas by an Act passed in the sixth and seventh years of the reign of her present Majesty it was enacted, from and after the first day of October, one thousand eight hundred and forty-three, no person or persons should be assessed or rated or liable to be assessed or rated or liable to pay to any county, borough, parochial, or other local rates or cesses, in respect of any lands, houses, or buildings, or parts of houses or buildings, belonging to any Society instituted for purposes of science, literature, or the fine arts exclusively, either as tenant or as owner, and occupied by it for the transaction of its business and for carrying into effect its purposes; provided that such Society should be supported wholly or in part by annual voluntary contributions, and should not, and by its laws might not, make any dividend, gift, division, or bonus in money unto or between any of its members; and provided also, that such Society should obtain the certificate of the barrister-at-law or Lord Advocate as therein-after mentioned. And whereas it is expedient to amend the said statute. Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1. From and after the first day of January, one thousand eight hundred and fifty seven, so much of the said Act as is herein-before recited, as also the whole of section six of the said Act, shall be repealed.

II. From and after the first day of January, one thousand eight hundred and fifty-seven, no person or persons shall be assessed or rated or liable to pay to any county, borough, parochial, or other local rates or cesses, in respect of any lands, houses, or buildings, or parts of houses or buildings, belonging to any Society instituted for purposes of science, literature, education, or the fine arts, either as tenant or as owner, and occupied by it* for the transaction of its business and for carrying into effect its purposes; provided that such Society shall be supported wholly or in part by annual voluntary contributions, and shall not, and by its laws may not, make any dividend, gift, donation, or bonus in money unto or between any of its members; and provided also, that such Society shall obtain the certificate of the barrister-at-law as provided by the recited Act, or the certificate of the registrar of Friendly Societies in Scotland as hereinafter provided.

III.* The certificate directed by the recited Act to be obtained from the Lord Advocate, or any depute appointed by him to certify the rules of Friendly Societies in Scotland, shall, from and after the first day of January, one thousand eight hundred and fifty seven, be applied for to and issued by the registrar of Friendly Societies in Scotland; and all the powers, duties, and provisions by the recited Act made applicable to the Lord Advocate or such depute shall be transferred to and be applicable to such registrar; and all the powers, duties, and provisions by the recited Act granted, imposed upon, or made applicable to the clerk of the peace for the borough or county shall, in Scotland, be applicable to the sheriff clerk of the county where the lands, houses, or buildings of the Society are situate; and all the powers, duties, and provisions by the recited Act granted, imposed upon, or made applicable to the recorder or justices for the borough or county shall, in Scotland, be applicable to the sheriff of the county where such lands, houses, or buildings are situate, in the same manner and to the same effect as the same are by the recited Act made applicable to such clerk of the peace, recorder, or justices respectively.

IV. Whenever any such Society shall have obtained the certificate of the barrister-at-law or such registrar, and the laws, rules, and regulations of the Society shall have been allowed and confirmed by the recorder of any borough sessions, or the justices at any general quarter sessions, or the sheriff, or if such certificate of the barrister-at-law or registrar shall be refused, but such recorder or justices or sheriff, on such laws, rules, and regulations being submitted to them respectively, shall order the same to be filed, notwithstanding such refusal, then it shall not be lawful thereafter to assess or rate any person or persons, nor shall any person or persons be liable to be assessed or rated or liable to pay to any county borough, parochial, or other local rates or cesses, in respect of any land, houses, or buildings, or parts of houses or buildings, belonging to any such Society, and any such assessment or rate, if made, shall be wholly void, and no person or persons assessed to any rate from which any Society shall be exempted by this Act shall have any appeal or right to appeal against such certificate, or against such allowance or confirmation or filing of the laws, rules, and regulations as aforesaid; provided nevertheless, that if at any time the laws, rules, and regulations of any such Society shall be altered or varied, or if any such Society shall be conducted for purposes different from those set forth in the laws, rules, and regulations, after the same shall have been allowed and confirmed or filed, the exemption from rates and cesses herein contained shall cease; but nothing herein contained shall prevent any such Society from applying for a fresh certificate, or from applying to have its laws, rules, and regulations again allowed and confirmed or filed, as often as need be.†

The Council will be glad to receive observations and suggestions on the foregoing, for discussion in the *Journal* or otherwise.

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* Had time permitted the carrying this Bill through the House last Session, it would have been proposed to insert here, between "it" and "for," the word "exclusively," objection having been made that the mere occupancy of the buildings by a Literary Society ought not to exempt those buildings when used for other purposes.

* This whole clause was introduced in Committee, and words were inserted into the other clauses of the Bill in order to adapt it to existing circumstances in Scotland.

† The Bill was originally prepared by Charles Wordsworth, Esq., Barrister, of the Inner Temple.

PARIS IMPROVEMENTS.

It will be recollected that some time since a Committee of the Society was appointed to take up this subject, with a view specially to obtaining information as to the manner in which the improvements in the streets of Paris were effected. The following information relative to the mode in which the legal proceedings connected with the compulsory taking possession of private property for such purposes has been obtained, and but for pressure of other matter would have been published earlier.

The law of France is based on the following general considerations.

Undertakings for the public good involve private interests in a certain amount of sacrifice, though they share in the general profit and advantage arising from them, and regulations to meet this view are accordingly adopted. Some of these regulations relate to the mode in which such parties should share in the expenses and profits; others refer to compulsory taking of land; and, again, some others refer to injuries affecting the property and rights of individuals, and to the compensation they may be entitled to. In certain cases, public works may be undertaken for the benefit of private property. They may likewise be useful and beneficial to a limited number of proprietors. The duty of the public administration* is, in both cases, to superintend the execution of such works, and to procure, or, at any rate, to enforce regularity in the working by all parties interested therein. The outlay is equitably divided among those who are to profit by such works, and in proportion to the benefit accruing to them therefrom.

1.—Public Works, in which both the State and Individuals are concerned.

General Rules.—Whenever it becomes necessary to undertake works for the protection of private property against the invasion of the sea, the overflowing of rivers, torrents, &c., the government has the right to impose upon the *communes* and proprietors of the adjacent country a certain amount of the expenses, in proportion to their interest in the matter. In some cases, however, the government grants, when needed, a portion of the public monies for the furtherance of the above object. Under the constitutional, as well as under the present government, such taxes or impositions on the part of the departments, communes, and towns, are drawn up into a bill, and voted by the Lower Chamber. The same principle is adopted and followed in regard to canals, parish roads, &c.

If, in consequence of any new public works, such as the opening of roads, streets, squares, the building of quays in cities, property situated upon such thoroughfares is highly increased in value (*plus value*), the owners may be obliged to pay either to the commune, department, or State, a sum of money, the amount of which must never exceed half the sum representing the pecuniary profit thus accruing to the parties interested.

In such cases, an estimate is made in a regular form, and the matter is legally decided by a committee named for that special purpose.

The amount is paid by the individual at his own option, either in ready money or in 4 per cent. annuities, or by giving up a portion of his property, if such an arrangement is capable of being carried out.

The owner may also give up all his lands or buildings which have thus acquired an increased value; but in such cases the estimate is grounded upon the previous value of the property, before the execution of the public works to which their increased value is due.

The monies paid as above by proprietors do not become due till a decree is issued by the government, upon the application of the minister of the home department, and after all the parties concerned have been heard, such decree (*réglement d'administration publique**) reciting that the articles of the law as above-mentioned are applicable.

From the above rules, it is evident that the government is supreme judge and arbiter in such matters.

2.—Compulsory taking of Lands.

It is a principle of the French law, that private interest must yield to that of the public; hence, private individuals may be compelled to part with their property when required for the public good, but in such cases respect for the rights of property demands that the owner be indemnified.

The government is the sole authority invested with the power of declaring in what cases such "public good" really exists, but the local authorities are empowered to apply the law and settle the interests of private property.

According to the French law, the Courts of Justice decide upon the manner in which compulsory possession is to take place. A special jury gives its verdict as to the amount of compensation to which a proprietor is entitled.

The form of legal proceedings in these cases may be summed up as follows:—

A. *General Regulations.*—The Courts of Justice alone have a right to decide in reference to cases of compulsory taking of property when required for the benefit of the public.

They can, however, never pronounce sentence for a compulsory sale until the question of "public good" has been previously determined and published by the competent authorities, viz.,

1. The law, or decree, authorising the execution of the works which render the compulsory sales necessary.
2. An act or *arrête* of the local prefect, pointing out the place or district in which the works are to be constructed, whenever it is not specified in the law or decree itself.
3. A subsequent decree of the prefect, showing the private properties liable to compulsory sale.

No lands or property can be taken under this last decree until all parties have had the opportunity of laying before the Court the circumstances of their case.

The engineers or other officers entrusted with the execution of the works must, in each parish or commune, prepare a detailed plan or survey of such lands, estates, and buildings, as they deem necessary to be purchased.

The surveys of such properties, together with the names of each owner, as they stand on the public register, are to be deposited for the space of eight days at the town-hall or *mairie* of the commune where the above properties are situate, in order that every person may have opportunity of becoming acquainted therewith.

All parties are required by notice, within one week to take cognisance of the plan deposited at the town-hall.

Such notice is affixed to the door of the parish-church and of the *mairie*, is published by the crier, and is inserted in one of the local journals.

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* "*Administration Publique*" applies to public authorities of all kinds, whether municipal or govermental.

* These decrees or *reglements* are always discussed or framed by the Council of State.

The mayor, by his signature and seal, authenticates the notice, and subsequently certifies in a report, which is also signed by the parties, the claims made by them, and he draws up a copy of such others as may have been transmitted to him in writing.

At the expiration of the above week, a committee assembles at the *chef lieu de préfecture*.

This committee, under the presidency of the prefect, is formed of four members belonging to the council-general of the department,* or to the council of the arrondissement named by the prefect; of the mayor of the commune in which the properties in question are situated; and of one of the engineers who is to undertake the works.

No proprietor whose property is liable to be taken can be a member of the Committee.

The Committee is bound to give a hearing to any statement made by the proprietors, during the space of one week. Proprietors may be called before the Committee, whenever it is deemed proper, and the members are at liberty to give their individual or collective opinion.

The sitting of the Committee must be closed at the end of ten days; after which the report of its proceedings is addressed by the sub-prefect to the prefect.

In case of the business not having been brought to a close in the course of the above ten days, the sub-prefect must transmit in the ensuing three days a report to the prefect, together with the minutes of the proceedings.

Should the Committee propose any alteration in the plan presented by the engineers, it is the duty of the sub-prefect to give notice thereof to such proprietors as may be affected by the alteration. During the whole week following the day on which that notice is given, the report and minutes are to remain at the offices of the *sous-préfecture*, where the parties so concerned may procure copies without expense. They have the opportunity of depositing any statements they please.

At the end of three days after the sittings of the Committee are closed, the sub-prefect hands over the documents to the prefect, who determines what properties are to be sold, and the time at which possession of them must be taken. However, if the Committee be of opinion that an alteration is necessary in the proposed works, the prefect suspends the operations, and reports the case for decision to the government.

According to circumstances, the government is at liberty, either to determine immediately on the case, or to issue an order that the whole or part of the above proceedings shall be gone through anew.

From the preceding details, it is easy to see that the final decision of any litigated case is within the hands of government. In questions of real importance, the result of the system is beneficial, as it tends to get rid of local jealousies, the delays of lawyers and extortionate demands. But in matters of smaller importance, the system is found to work oppressively, as in consequence of the extreme centralisation, works of real practical utility have been delayed for a length of time. One of the objects of the Legislative Assembly under the late republic was to do away with these defects of the system, by giving more power and freedom of action to local administrations.

The Council of State is the real arbiter of such cases which fall within its jurisdiction.

COMPENSATIONS.

1.—*Preliminary Measures.*—In the week following upon the above-mentioned notices, the "proprietor" is bound to call together and to make known to the Administration, the farmers, tenants, lodgers, beneficial occupants, or any others who may lay claim to interests arising out of the legal rights, or under deeds to which he has become a party. In case of non-fulfilment of this obligation on the part of the proprietor, he is liable to them for the payment of such compensation as the above persons may be entitled to.

Other parties interested in the property are considered as having received due notice through the publicity given to the intended measures. They are, therefore, obliged to send in their claims to the administration in the same above-mentioned week, on pain of forfeiting their rights and privileges to a compensation.

During the same week, the local administration gives notice to the respective parties of the sum allotted to them as a compensation. These offers or allotments are posted and published in the usual way.

A fortnight is given to the parties to make known their acceptance or refusal of such offers, as well as to communicate the amount of their own valuation of their own claims.

In some special cases the above term is extended to a whole month.

Should the pecuniary compensation offered by the local administration not be accepted during the prescribed time, the administration summons the parties to appear before a special jury empanelled for the occasion, to assess the amount. The summons must contain the precise terms which have been offered.

2.—*Special Jury.*—During the course of its yearly meeting, the council-general of each department draws up a list, in every *arrondissement*, of electors, amounting to not less than thirty-six, and not more than seventy-two persons, who have their legal abode in the department. From this list are chosen the members of the special jury which is to decide upon questions of compensation in cases of compulsory sales.

The number of jurors thus designated for the department of the Seine* amounts to six hundred.

Whenever it becomes necessary to call a special jury of the above kind, the first chamber of the Court of Appeal in the departments where that court holds its sittings, and, in the other departments, the first chamber of the *Tribunal de Première Instance*, selects out of the aforesaid list, sixteen persons who are to form the special jury in question.† Should the judges refuse to select the jury, the duty falls upon the Court of Appeal.

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* In every department there exists a council-general, which holds annual sessions lasting a fortnight. Those sessions usually take place in September. Every canton or district of a department has a right to elect a member of the council, in an assembly formed of citizens enjoying their civil and political franchise. The number of councillors can never be more than thirty. They are elected for nine years, but one-third of the council is subjected to re-election every three years. The public functionaries of the department are not eligible for the council-general. The duties of this body may be summed up in a few words: the council deliberates and votes upon all local matters not falling within the limits of the "public service." It likewise votes the sums necessary for the administration and expenditure of the department. There is likewise in each arrondissement or sous-préfecture an inferior but equally elective council, whose organisation and duties are much about the same as the council-general, but the sphere of its action is limited to the arrondissement. The members are elected for a period of six years; but the council is liable to re-election every three years. The annual session lasts five days.

* The department of the Seine is exceptional.

† The French courts of law are organised as follows:—A.—*Cour de Premiere Instance.*—The lowest court of jurisdiction, dividing itself into chambers or courts of civil law—criminal law and police offences—commercial law. In Paris, the police has a separate organisation. B.—*Cour d'Appel*, superior to the former, from which appeals are made to the latter. A somewhat smiliar division takes place. C.—*Supreme Court of Cassation*, which is empowered to confirm or annul the sentences of inferior jurisdictions, for some deficiency in point of legal forms; but cannot pronounce judgment upon the merits of the case in criminal prosecutions. On such occasions, the case is remitted to another jury, and frequently in another department. D.—The Council of State enjoys a certain jurisdiction over cases litigated between the Government and private individuals; but appeal may be made from its decisions to the common Courts of Justice.

None of the interested parties, such as proprietors, farmers, creditors, &c., can become members of the jury.

This list of sixteen jurors, to which are added four supplementary jurors, is transmitted by the prefect to the sub-prefect, who, after consulting with the judge who is to preside over the jury, calls them together and summons the parties to attend, giving them at least a week's previous notice, stating the place and day of sitting. In the summons the names of the jurors must be communicated to the parties.

Every juror who, without any lawful reason, does not attend the sittings, or refuses to take his share in the sittings, is liable to a fine of 300f. at most, and 100f. at least.

The fine is adjudged by the president of the jury, who likewise decides without appeal upon any excuses made by the condemned juror; he likewise decides upon cases of competency of the jurors, arising from circumstances unknown previously to the impanelling of the jury.

Such jurors as are struck out of the list in consequence of such impediments, are immediately replaced by the supplementary jurors, who are called into court by the president, according to the date of their inscription on the list.

In case of an insufficient number, the judge selects from the general list the persons necessary to make up a quorum.

The public administration, as well as the parties themselves, have a right twice to put in a peremptory challenge against the jury.

In case of several parties being concerned in the same case, they must come to a mutual understanding in regard to exerting their right of challenge, otherwise it must be decided by lot which of them shall exercise that right.

If the right of challenge be not exercised, the president of the jury proceeds to reduce the number from sixteen to twelve, beginning with the last names on the panel.

The special jury is not considered formed until the twelve jurors are in attendance.

The presence of nine persons is sufficient to make a quorum.

When the jury is completed, each juror takes an oath to fulfil his duty with impartiality.

The president places before the jury, 1st, a tabular notice of the offers and claims duly made according to law; 2ndly, the several plans, titles, and documents brought forward by the parties in support of their claims.

The parties or their attornies are at liberty to offer their observations.

The jury is empowered to call in any persons they may think proper, by way of procuring useful information.

They may likewise repair to the spot, or delegate one of the jurors for the same purpose.

The sittings are public, and may be continued from one sitting to another.

The close of the inquiries and discussion is declared by the president.

The jury immediately retire from the box, in order to consider without delay on their verdict, under the direction of one of their members, acting as a foreman, and elected by them on the spot.

In case of equality of votes on a division, the foreman's vote gives the majority.

The jury awards separate and distinct compensation to such parties as may put in claims grounded on different titles, such as owners, farmers, tenants, &c.

Should any difficulty occur as to the validity of those titles, the jury still awards the compensations; but the parties are passed over to the competent courts to decide on the disputed rights.

In no case can the pecuniary compensation awarded by the jury be less than that offered by the administration, nor greater than that claimed by the parties themselves.

If the compensation awarded does not exceed the sum offered by the administration, the parties refusing have to pay the costs.

If the compensation be the same as the claims of parties, the administration is liable to the costs.

If the compensation awarded turns out to be larger than the offers made by the administration, and smaller than the amount asked, the costs are divided in the proportion which the offers and claims bear to the amount assessed by the jury.

The verdict of the jury, signed by the jurors, is delivered by their foreman into the hands of the president, who decrees it to be put into execution, awards the costs, and issues orders for putting the administration in possession of the property.

The verdict and president's decree cannot be appealed from, unless before the Supreme Court of Cassation, in which case the proceedings may, when the decision is annulled, be remitted to another special jury of a neighbouring *arrondissement*. A fortnight's delay is allowed for such appeals.

The jury is obliged to decide upon every case submitted to it, and without any interruption, before its members are allowed to depart.

The same jurors who have served for the term of one year, cannot again be placed upon the panel by the council-general for the ensuing year.

(*To be continued.*)

RECENTLY DISCOVERED LITHOGRAPHIC STONE IN JAMAICA.*

Being a Paper read before the Royal Society of Arts of Jamaica. By E. C. Lewis.

In obedience to the request of your honourable Chairman, at a meeting held on the 30th March, on my exhibiting specimens of the grey lithographic stone, I readily respond to the call, and cheerfully lay before the Society a few particulars relating to my recent discovery, in the parish of Saint George, in this island, of several extensive quarries of a valuable stone, or compact carbonate of lime of calco-argillaceous nature, of a blueish grey tint, and a cream colour, displaying a conchoidal fracture, and suitable for lithographic, monumental, and statuary purposes, tablets, fonts, fountains, vases, hones, and an excellent cement, &c. The inferior portion being to a very considerable extent adapted to ornamental architecture, is worthy the attention of the geologist and man of science, as it is of the man of capital, who may feel disposed to unravel and develop a portion of the vast resources of this important island, and who would thus not only enrich himself, but insure a splendid monument for himself and family, by exerting every endeavour to avail himself of the liberality of the proprietor, and proceeding forthwith in the most energetic manner possible.

A more extended surface of the most valuable blocks of stone and slabs can scarcely be conceived in any inhabited country, laid bare by the hand of nature and the elements, exposed to view for ages past in large ravines (or gullies), and in such profusion that the roads are paved with it, walls built of it, the steps and foundation of even the rustic cottage based upon it, and yet, its valuable qualities have remained so long overlooked and unappreciated within three or four miles of the shipping port of Buff Bay, and on the banks of the White River, which winds for miles through these valuable properties which until very recently have been allowed to return to their primitive condition, amidst the wreck of surrounding coffee plantations.

The geologist may there find a fertile field for explorations, amidst the tertiary and the lias series, of which the basis of some of the mountains of Belvidere and an adjoining property appears to be formed, and the intended museum of this Society may, in all probability, be the receptacle for many valuable specimens of the antediluvian age, or relics of antiquity, in the form of organic fossil remains.

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* Specimens of this stone are promised, and are expected shortly at the Society's House, John-street, Adelphi.—Ed. S. A. J.

With the desire to be useful in any future exploration, I shall willingly submit such things as may present themselves worthy of your notice, and with a tender of my best services in any way they can be rendered available in carrying out the important objects of your invaluable institution.

Emboldened by the favourable reception of my previous communication on the subject of the Jamaica lithographic stone, and impressed with the importance of the subject to many in this island, I now offer further particulars of its locality and formation, with the view to awaken attention to the subject, and induce some of your scientific body to visit the quarries, promising the geologist ample gratification, and those who may take an interest in it a wide field for future operations, with every prospect of reward. In the interim this may elicit further information on a highly-interesting subject.

I need scarcely remind you of the increasing importance of the finer varieties of this stone for artistic purposes—it is, indeed, fast superseding steel for the engraver, and is a material by no means widely distributed. Munich, in Germany, where its use was first discovered, affords a very considerable supply. I am not without hope that this, our island, may prove a powerful competitor with any country, the quality of some of the specimens having been pronounced by a competent lithographer, "equal to any in the world."

The valley of the White River, in St. George, on the north side of the island, appears, so far as I have been able to trace its geological formation, to range from the tertiary to the lias series (or generally so), but there are specimens of the greyish blue lias, in blocks of some tons weight, of an amorphic structure, and the exterior is so disintegrated or cracked in all directions (the result probably of atmospheric influence), as to be rendered at once suitable to the kiln, it being admirably adapted to the preparation of a cement, which readily sets under water.

On Belvidere estate alone, I have already been able to trace four ravines, exhibiting these stones in profusion, loosely aggregrated, and in mass. The public road passes across what may be considered the centre of the whole, and the largest, or "Collin's Gully" (fortunately the nearest to the Barqudier), is apparently the most valuable, from the quality and variety of the stone. It presents a particularly interesting view, not only from its extent, but as exhibiting one of the finest galleries of the tertiary, or nearly horizontal strata, from a few feet to a few inches in thickness, separated only by thin layers of sand and clay. These slabs could easily be detached, of any size, as the gallery is perfectly accessible; but this variety of the stone is of a coarser grain than many blocks and slabs of a cream colour already quarried, many tons of which are only waiting for the roads to be rendered passable, and a vessel to receive them. Altogether, the appearances presented by this quarry are exceedingly interesting; some of the ravines are much torn open by the occasional violent rush of water, and many valuable stones have thus been conveyed to the bed of the stream, which doubtless takes its name from the variety of white stones over which it passes.

Appearances seem to warrant the belief that the whole of the mountain, at least on one side of the river, is a mass of this stone, and blocks of every dimension meet the eye, in looking either up or down the ravines, generally of a superior character, adapted for the artist, or the architect, and mostly of a quality to compete with that used in the construction of palaces and public buildings in Paris, Constantinople, and elsewhere.

Near the bed of the river is another road, which might be extended through the property, and a tram laid down for conveying the stone to a carriage road about two miles from Buff Bay, and possibly to the bay or wharf.

Lairy, the property adjoining Belvidere, and on the road towards the Bay, belonging to the same proprietor, exhibits the same geological formation, having a ravine of similar indications, and possessing the advantage of being still nearer to the shipping port. Much of the stone on this property is of a quality particularly adapted to monumental and exterior purposes, acquiring, on exposure, a peculiar crystallised glistening appearance.

The cultivation of estates in the quarter having almost entirely ceased, with little chance of resuscitation, the present appears a favourable opportunity to obtain labour at a reasonable rate, and those willing to work would have every facility in obtaining a livelihood—the exuberance of the soil in that quarter affording ample advantages for thousands to locate there.

ART TREASURES EXHIBITION.

The length of the building is now clearly shown, the terminal walls, front and back, being some 25 feet above ground. The length is, as has been before stated, 704 feet; this is just about the same length as the *Great Eastern* steamship, which is 700 feet long. She could therefore be barely docked in this immense building, fore and aft. The breadth of the great hall, to the columns which divide it from the aisles, will be 54 feet; the beam of the *Great Eastern* is 60 feet; so that by making an allowance of one yard outside the two rows of hall columns, for breadth, and taking the end walls as boundaries for length, an exact idea of that monster ship may be realised. The entire breadth of the Exhibition building will be 200 feet.

There is an immense quantity of building material spread upon the site, at the points where it will be wanted, consisting of iron, wood, and bricks. Nearly one million of bricks have already been placed. The steers of timber, chiefly in boards, are all but incredible, and, with the bricks, are supplied by Messrs. Bennet, of Ardwick. As giving some idea of the quantity of wood required, the following items may be mentioned; 8,400 joists, 12 feet long; 2,000 ditto, eight feet long; 140,800 boards, 12 feet long, 1¼in. thick; 265,600 ditto, 12 feet long, ¾in. thick; 25,000 scantlings, 12 feet long, 4in. by 3in.; and 10,000 ditto, 3in. by 3in. This gives a total of 451,200 pieces; yet, notwithstanding this, the only woodwork visible will be the floors.

The Earl of Ellesmere has promised twelve pictures from his gallery, most of them of the first class in their respective schools, and contributions are promised among others by the Duke of Manchester, Sir Philip Malpas de Grey-Egerton, M.P., of Oulton-park, Cheshire, William Tite, Esq., M.P., George Cornwall Legh, Esq., M.P. (North Cheshire), the Earl of Clarendon, the Bishop of Ripon, William Ewart, Esq., M.P., Lord Wharncliffe, Lord Willoughby d'Eresby, M. Rohde Hawkins, Esq., of Stanhope-street, Hyde-park-gardens, I. K. Brunel, Esq., the Hon. Ashley Ponsonby, &c.

The varied nature of these offers of works of art (especially of two or three pictures only) may serve to encourage others who, because they have not large collections, may hitherto have been unwilling to come forward with an offer of one or two paintings, however rare or valuable. Of course all offers are subject to the selection and approval of the executive committee, who continue to receive numerous letters, expressive of the strongest feelings of approval of the object, and of a desire on the part of the respective writers to promote that object by every means within their power.

METALLIC PONTOON WAGGONS.[*]

In pursuance of directions received from the Secretary of State for the War Department, Mr. Francis's floating metallic pontoon-waggon, which was tested in sundry ways a short time back in the outer basin of Woolwich Dockyard, was, on Wednesday last, submitted to some additional trials on the canal in the Royal Arsenal. These experiments were watched on the part of Government by Colonel Bainbrigge, R.E., Inspector of Fortifications; Captain Caffin, C.B., Director-General of Naval Artillery; Captain Boxer, R.A., Superintendent of the Laboratory in Woolwich Arsenal; Captain T. A. Campbell, Assistant-Secretary to the Select Committee; Captain Clark, R.A., acting military superintendent of the carriage factory; and Mr. Abel, superintendent of the chemical department of the Laboratory. Mr. Francis, the patentee, was present to direct the experiments. The first experiment consisted in thrusting the waggon, with the whole of its appurtenances, feeding trough and gear attached, into the water. Seven men then entered the waggon, and rolled and rocked about, and endeavoured to capsize it, but they could not succeed in bringing the gunwale to the water's edge. Boxes of iron, weighing 12 cwt., were then added, making the aggregate weight amount to 21½ cwt. The waggon was then rowed across the water to prove its floating capabilities, and also to show the advantage which an army would possess in crossing unfordable rivers, if supplied with these pontoon-waggons, which are driven through the stream without the necessity of detaching the horses. Some very powerful efforts were again made to upset it, but without success. It was then hoisted out of the water by means of a crane, without removing any of the load, and cleared out, the body being taken off and again thrown into the water. Seven men were ordered into the boat, and the boxes of iron were increased to 22 cwt. It was then rowed about, rolled and rocked as before, and struck with a sledge-hammer some 20 or 30 blows on one spot, without any visible effect on the rivets or joints. After being carefully examined, it was mounted on its carriage, and dragged up to the practising butt. An artilleryman, standing at a range of 100 yards, then fired a couple of Minié rifle balls through the sides. In each case the ball traversed, without splintering, clean through the body, carrying with it a portion of the metal. The success of this experiment was considered of great importance, as considerable injury results in many cases from the scattered splinters of the carriages in present use. Mr. Francis then got into the waggon, and closed the perforations with a few blows of a hammer, leaving only the spots which had been carried away by the balls. This, he explained, could be repaired in the most simple manner by anyone, "with any bit of metal and two or three old nails." A couple of the feeding-troughs serve as a canoe to convey one man with a paddle across a stream, and four of the bodies form an excellent raft, capable of supporting any heavy ordnance of the service. By keeping the running gear attached, they can be run in and out of the water with great facility; and, by making some alterations in the construction, it could be packed up in a small compass, for the convenience of transport.

MINING.

A report has just been published by Mr. Hugh Seymour Tremenheere on the mining districts, for 1856. After reporting the extension of associations for giving prizes in schools to South Wales and elsewhere, Mr. Tremenhere urges the necessity of a measure to compel all boys between 10 and 14 years of age, who work below ground, to attend some school for 100 hours every six months—a measure which, in the general opinion of all concerned, would be of great service, both to the labouring mining population and their employers. There is a general concurrence in the principle of the proposed measure, and a few objections of detail are satisfactorily disposed of by Mr. Tremenheere. The efforts at improvement made in the great mining districts of Monmouthshire and Glamorganshire are next noticed. The Chartist outbreak of 1839 having alarmed the proprietors, impelled them to action, and in successive years the great majority have taken some steps to provide for their people better means of moral, religious, and general instruction, and to facilitate the physical comforts and decencies of life among these large and rapidly collected populations. Gratifying instances of this care and forethought are given in the report. The unfeminine employment of women upon the "pit-banks and cinder-tips" has long been indicated as degrading to the female character, and as fraught with many and most obvious evils. A woman of this class, so brought up, and from an early age, marries at or soon after 20; and how, it is asked, is she qualified for the discharge of the conjugal duties? She does not know how to keep a house clean and tidy; she cannot cook; she is ignorant of the first principles of economy; and she knows nothing of the management of children. In connexion with this branch of the report, the neglect of some special instruction and training in nearly all female schools for the labouring classes is very properly pointed out as an evil that might easily be remedied, and various suggestions are made with this view, which, if carried out, could hardly fail to be most beneficial. The strike in the principal coal and iron districts in Scotland occupies the remainder of the report. The loss of wages between March and June (when the strike terminated) is estimated at a *minimum* of £500,000, but this very imperfectly represents the total loss inflicted upon the community. These strikes are likely to take place from time to time in Scotland, and the employers are urged to adopt, without delay, such measures as may tend to abridge their duration. Mr. Tremenheere thinks that it is possible, were the effort fairly made, to establish so much confidence between workmen and masters as should satisfy the former, when a demand for an increase of wages was resisted by the latter, that they really could not afford to comply with the request. And so, with relation to a lowering of wages, the facts upon which the master founds his plea for reduction should be patent to the men. Mr. Tremenheere deplores the fact that whenever any difference arises between masters and workmen, the question is immediately seized upon by delegates, "whose direct interest it is to aggravate every existing cause of dispute, and bring forward as many others as can be made available," and who, by generalising the question of wages for the whole district, do a great deal of harm; for one master, by his facility of communication, easy working of his minerals, &c., might be able to afford much better wages than another in the same locality. But these matters are entirely unestimated by paid delegates. The results of strikes are particularly noticeable in their moral and physical effects upon those engaged in them:—1. The diminution of crime. 2. The increase of disease. The low living produces low fevers, and if wet or cold weather comes on soon after a strike and before the stock of clothes which has usually been much reduced by being sold or pawned, can be replaced or recovered, an increased rate of mortality is the consequence. 3. Demoralised habits. The same observers, having experience of strikes for upwards of 30 years, notice with regret the injury done to the habits of a workman and his family by a strike. The loss of their usual resource of wages drives them to resort to means of saving themselves from starvation which an honest and well-behaved workman would not previously have thought himself capable of. Some get into debt to an amount which tempts them to become dishonest; others perambulate the country begging, or rather often extorting money or food; others send their wives or children, or both, on the same errand; in all cases their self-respect is impaired or destroyed, and when that is gone the descent is easy to crime and degradation.

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[*] A description of these waggons is given in Major Vincent Eyre's paper, published in the *Journal*, No. 196, p. 664.

RAILWAY SLEEPERS.

Dr. Boucherie, of Paris, states, in reference to this subject, that:—

"The *Times* of the 19th of August gives an account of an experiment, according to my processes for preserving timber, made by the engineers of the Permanent Way Company. This article has called forth from Mr. Bethell, of London, a reply, inserted in the *Times* of the 22nd ultimo. I cannot better repel the accusation of plagiarism which Mr. Bethell therein brings against me than by sending to England two official patents which may be seen at the office of the Permanent Way Company, and which have been given me by the French Government, in compliance with two applications for the same which I addressed to it. The first, the 11th of December, 1837, is for the process which I have pointed out, by means of which divers preservative substances are made to penetrate the tissues of wood, employing for that purpose that natural upward force by which the sap is rapidly transferred from the root to the top of the largest trees. Thus a tree of any size was, after being cut down, plunged at its lower end into a tub containing the liquid with which it was to be penetrated. Having found sundry inconveniences in this method of injection, my labours led me to discover a new mode, which I have described on the 30th of May, 1838, applying at the same time for an additional patent. This system consisted in placing one of the ends of the tree in a bag of waterproof cloth, firmly attached to its circumference, which bag communicated with a reservoir containing the liquid. Since then I have considerably modified my plans of operation, and these have been the subject of several subsequent patents. On the 10th of July, 1838 (that is to say seven months after my first patent, and 42 days after the second), Mr. J. Bethell took out a patent in England for the preservation of wood. In his specification three plans are described. 1. The making the preserving liquid penetrate by capillary attraction,—the natural method described in my patent of the 11th of December, 1837. 2. Penetration by capping with an india-rubber bag communicating with a reservoir,—the mode pointed out in my additional patent of the 30th of May, 1838. 3. Penetration by mechanical vacuum and pressure,—a system the priority of which can be easily claimed by M. Bréant. I leave others to judge to whom belongs the title of inventor. It is true that in 1840 my processes were patented in England in the name of a London merchant, but I do not think that anyone is authorised to assume the title of inventor by the single fact that he may have been more in haste than the inventor was to patent in a foreign land the object of his invention, especially when his birthplace is only separated by an interval which a few hours suffice to pass over. It does not belong to me to eulogise my discovery; I shall confine myself to saying that it has gained for me at all the French Expositions the first gold medals; at the London Exhibition the same reward as was given to Mr. Bethell; and at the Universal Exhibition at Paris one of the four great medals of honour; further, by a special law, unprecedented in France, an extension has been granted to my patent. All my labours and numerous experiments have proved to me that, in proportion as the preservation of the timber takes place before the drying up of the sap in the fibres, it is the more complete if the sap is expelled, to make way for preservative substances.

"It is, then, important to subject timber, within two or three months after felling, to that preparation which gives it durability, the limits of which have not yet been found.

"The difficulty of using my process in England is not so great as Mr. Bethell is pleased to represent. Nothing is easier than to have the timber prepared in the midst of the forests which supply the markets of Britain; it is a problem most easy to solve, if but the appeal be made to the fertile intelligence of English industrialists."

INVENTION OF PHOTOGRAPHY.

In a French work, lately published,* in which a review is given of the results of photography, as shown in the Paris Exhibition of 1855, after awarding great praise to the works of Mons. Bayard there displayed, the author proceeds as follows:—

"Mons. Bayard is one of the inventors of photography on paper. When this discovery existed only in the limbo of science, that is, before the publications of Fox Talbot, he, by himself, had already discovered, in his own secluded retreat, the method of fixing on paper the images of the camera obscura. The fact, at the present time, is almost unknown. For this reason, if the reader will permit me to digress, I will relate how Mons. Bayard came to discover the art of photography on paper, and how his discovery has remained a secret from all. The tale, besides, is not long; in fact, as we should say, it is only the history of a peach. Mons. Bayard is the son of a respectable local judge, who exercised his duties in a small provincial town. He occupied his leisure hours in cultivating his garden. In this garden was an orchard, whose splendid peaches ripened under the autumn sun. Mons. Bayard, the father, was in the habit every year of sending to his friends baskets of this fine fruit, and with the natural pride of a proprietor, he took pains, when he sent them out, to mark by some unmistakeable sign that the fruits were the produce of his garden. He conceived a singular mode of effecting his object, which, unknown to the inventor, was a real photographic process. He picked out a peach on the tree in the process of ripening; it was, as you may imagine, one of the best—one of those "*pêches à trente sous*," which, in after times, thanks to Mons. Alexandre Dumas the younger, have played so conspicuous a part in the world—or rather, the dramatic world. In order to preserve it from the action of the sun's rays, our judge took care to cover his peach with leaves. When the peach thus defended from the sun's rays had acquired the desired size, he pulled off the leafy covering, and left the fruit freely exposed to the influence of the light, save that he gummed on the surface of it the two initial letters of his name, neatly cut in paper characters. At the end of a few days, when the protecting papers were removed, the two initials were found distinctly marked in white on the red ground of the fruit, which thus became impressed with an unquestionable stamp at no greater cost than the sun's rays. This occurrence, which young Bayard each year was in the habit of witnessing, naturally made an impression on his mind. As a child, he amused himself by repeating this effect of the sun on pieces of pink paper braided into the form of a cross. The parts of the paper concealed from the light by the overlying bands preserved their colour, while the other parts were quickly bleached. Afterwards, having tried, like many others, to fix the images of the camera-obscura, Mons. Bayard conceived the idea of using for the purpose the rose-coloured paper which had served to divert his infancy. But, placed in the camera, the paper was not sufficiently sensitive to the light. Mons. Bayard then resorted to the use of chloride of silver in lieu of this inactive paper—the very photographic agent in use at the present time. He thus succeeded in obtaining actual photographic impressions on paper, with this remarkable circumstance that the images were direct, that is, without the necessity for the use of a previous negative. In the picture obtained, the lights corresponded to the lights of the object, the blacks to the shadows. His process consisted in exposing paper impregnated with chloride of silver to the action of the light, but only up to a certain point which experience had taught him. When he wished to use it for obtaining a photographic image, he soaked this paper in a solution of iodide of potassium, and exposed it to the action of the light in the camera-obscura. The rays of light had the effect of blanching, or rather of giving a very light yellow tint to the silver salt in those parts on which the light shone. There remained only to fix the images by means of hyposulphite of soda. Such is the process of photography on paper which Mons. Bayard invented, and which he, for the sake of his reputation, was to blame in desiring to keep secret. It was then that those beautiful impressions were obtained which Mons. Depretz shewed us, fifteen years ago, at his lectures on Physics, at the Sorbonne, and which we passed from hand to hand without being able to guess by what magic such marvels had been produced. How could it be guessed that such splendid effects had their origin simply from observing the action of the sun's rays on a peach, and that the delicious gift of the Persian of old had exercised so great an influence on the progress of modern physical science. These very pictures, which so charmed us at the Sorbonne, I think I had the pleasure of recognising in the case sent by Mons. Bayard to the Exhibition. Of course, it is understood that Mons. Bayard no longer obtains his pictures by his old method. He now practises, like almost everybody else, photography on glass, but he has carried it to great perfection."

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* "Les Applications Nouvelles de la Science à l'Industrie et aux Arts en 1855." Par Louis Figuier, Docteur ès Sciences Docteur en Médecine, agrégé de Chimie à l'Ecole de Pharmacie de Paris, &c. Paris: Victor Masson, Place de la Ecole de Médecine, 17; Langloit et Leclerq, Rue des Mathurins St. Jacques, 10. 1856.

A RAILROAD HOTEL CAR.

A car lately put on the Illinois Central Railroad contains six state rooms, each room having two seats with cushioned backs, large enough for a person to lie on. The backs of the seats are hung with hinges at the upper edge, so that they may be turned up at pleasure, thus forming two single berths, one over the other, where persons may sleep with comfort. In one end of the car is a small wash room. On the opposite side of the car from the state rooms is a row of seats, with revolving backs, similar to barbers' chairs, so arranged that the occupant may sit straight, or recline in an easy attitude, at pleasure. There are other cars on the same road which have each two or three similar state-rooms.

It is suggested that to this car there should be added the means of supplying meals at moderate prices, at all hours, and that this would make railroad travelling positively perfect. It would be a good plan on all railroads more than a hundred miles long, to have a special car where refreshments could be obtained at reasonable prices. The houses of refreshment at railroad stations, where passengers are compelled to run "when the bell rings" to the great danger of their limbs, and the loss of many sixpences, ought to be swept away to make room for some better system, whatever that may be.

Home Correspondence.

EXAMINATIONS.

Sir,—The more the advantages likely to result from the Society's system of examinations are appreciated, the more anxiety will naturally be felt that those benefits should be extended as widely as possible. A correspondent, in your last number, suggests that commercial and trade schools should be allowed to send up candidates; and though this may well be a matter for consideration, the serious difficulty that now presents itself is—how are the members of those Institutions who have not friends to pay the travelling expenses of their candidates to obtain the advantages offered? Various suggestions as to the best means of thus placing all upon an equality were made at the last annual conference, but I see that the Council have announced their intention of holding only two examinations, one in London, and another in the north of England; and, although there is but little doubt that the populous districts round Liverpool and Manchester will find this second examination a great boon, and that many more candidates from among the well-informed artisans of that part of England will appear than would have been the case had the journey to London been necessary, how many in the western and other distant counties will still be prevented from coming by want of funds. This is a difficulty which I will not attempt to solve, but surely some of your correspondents might suggest some means of overcoming it. There is much time for consideration, as the next examinations will not take place for many months, and I cannot but hope that, in the interval, some plan may be hit upon for rendering still more general and effective this noble effort of the Society of Arts to develop the latent talent and industry of the working-man.

I am, &c.,
CANTAB.

THE PURIFYING OF WATER.

Sir,—During a late visit in a country parish, I ascertained that the only water which the inhabitants of a considerable village could procure for drinking purposes was that collected in one or more ponds. This water was much discoloured by earthy substances, and such is stated to be the usual condition there of this prime necessary of life.

Such a circumstance is sufficient to induce irregular habits; and I confess that, while I was enjoying many comforts close by, I could not but feel some remorse on reflecting that so many fellow-beings were unable to procure even a cup of pure water.

Surely, at a moderate outlay for a pump and filter, or some such means, this water-supply could be purified. I crave your assistance to obtain some *practical* information, whereby to realise my anticipation of relieving many deserving people from an evil at once unwholesome and of a degrading tendency.

LEONARD ROWE VALPY.

The Addison-road, Kensington.

AMPHIBIOUS CARRIAGES.

Sir,—Amphibious vehicles were invented by Sir Samuel Bentham, in 1781. The first was constructed at Nighue Taghil, a fabric of Prince Demidoff's, and was used by Bentham at the opening of the Government of Perme.

Having the command of two battalions, stationed the one at Kiachta, on the frontiers of China, the other along the banks of the Irtish, above 1,200 miles from each other, he constructed two carriages, of a more simple form than the first, to travel to and fro. In these, while posting, he crossed several rivers without any stoppage at the banks, the horses continuing their course across the river, swimming whenever they got out of their depth. And on his return from Siberia to Prince Potemkin's head quarters, at Jassy, his Highness ordered a corps of Chasseurs to be furnished with these amphibious carriages.

On the General's return to England, in 1794, he constructed a military baggage-waggon for the Duke of York, which his Royal Highness approved of, and exhibited on the Thames.

In 1805 the Emperor of Russia had a baggage-waggon constructed on the same principle at St. Petersburg, a model of which is mentioned in Dr. Granville's work, as deposited at the Admiralty there.

In 1830 Sir Samuel proposed to the Duke of Wellington that all military waggons should be amphibious. In most of these various amphibious vehicles several of his inventions were exhibited, such as the placing the plank diagonally, and forming the hull entirely of metal. Those made for the Duke of York were of tinned copper.*

Mr. Francis has the sole merit of corrugating the iron and of constructing an efficient apparatus for stamping it.

I am, &c.,
M. S. BENTHAM.

Proceedings of Institutions.

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Carlisle.—The annual general meeting of the members of the Church of England Religious and General Literary Association was held in the committee-room at the Athenæum, on Monday evening, the 18th ult., at eight o'clock. Among those present were—Hubert Rawson, Esq., of the Villa, Stanwix; Rev. W. Cockett (Upperby), Rev. James Tasker, Rev. J. Mc'Cartie (Scotby), R. Perring, Esq., Joseph Ferguson, Esq. (Lowther-street), Rev. Precentor Livingston, T. H. Redin, Esq., Wm. Carrick, Esq., Rev. W. Bell and Rev. J. Godding (High School), Rev. Minor-Canon Tireman, Rev. J. S. J. Watson (Stanwix), Mr. Fairlie, Mr. Heppell, Mr. Charters, Mr. Blamire, Mr. Geo. Harrington, Mr. F. Dickenson, Mr. E. G. Lloyd, Mr. J. B. Mullen, Mr. Malcolmson, Mr. Barnes (teacher), Mr. R. Wales, and Mr. Barns, the secretary.—The Chairman (H. Rawson, Esq.), in opening the proceedings, said he felt sorry that the duties of chairman had not fallen into abler hands; that they had not done so was not for the want of application, but, unfortunately, those who had been applied to were prevented from attending. Application was first made to the Bishop of the diocese, who, in a note, stated he regretted that owing to an engagement at home on the evening of the 18th he could not have the pleasure of accepting the invitation. The Dean had also been applied to, and he (the chairman) felt sure they all knew that the Dean took a deep interest in this Society; and nothing but the severe domestic affliction under which he was labouring, and other engagements pressing upon him, as well as considerable indisposition, prevented him from attending. The duties, however, would be light, and he (the chairman) should make a very few remarks prior to calling upon the Secretary to read the report. He felt great interest in this Society. He had taken an active part in its establishment, and very well recollected its first meeting at the Fawcett Schools. Ever since then he had looked upon the Society with great interest, and considered it an extremely important one. He regretted that it had not hitherto made such rapid progress as he hoped to see it make; still, it had made great progress, and he thought that when they heard the report read they would unite with him in that opinion. He considered it highly important that the Church of England should have a society of this description connected with it, and that its principles should be fairly and fully adhered to; and that whilst they rejoiced to see any other and every other effort made to advance the progress of society, and to improve the morals of the young men rising amongst us, they ought to feel great interest in the Society which was connected with their own Church. Therefore he hoped that the members present would communicate with others in making known its advantages, and so keep it up; that they would endeavour to augment its numbers; and, as far as possible, assist in working the Society and in carrying out its intentions. He believed the rules to be admirable. There were few wider spheres of usefulness than they had; they need not go abroad to do good, as they had the means within themselves, and if they did not bring out the results, it would be because they had themselves to blame. Looking at the Society since its commencement, they had great cause for thankfulness, and ought to rejoice that it was in the position it at present held. They would hear the various topics set forth in the report, and the remarks of the gentlemen who would move the resolutions. There was, however, one very gratifying feature in the Institution, and that was the increasing state of the library; and he might add that Mr. Head had promised another donation of books—a really valuable one; and, as part of it, they had the "Encyclopædia Britannica," in 27 volumes, in an adjoining room. Before he sat down he would say a word with regard to the financial report, which the Secretary would also read. There appeared a larger balance against the Society than last year, but they must not be discouraged on that account, as it arose from special causes. It had been thought desirable to increase the interest taken in the lectures, and, in order to do this, gentlemen had been brought from a distance, and the expenses had been very great. He felt sorry to say that the encouragement given was not sufficient to defray those expenses, a deficiency of between £20 and £30 being the result. Otherwise, he believed the ordinary expenses of the Society did not exceed the receipts, and that was a very gratifying feature in the report.—The Secretary then read the following report:—

"On this fifth anniversary of the Carlisle Church of England Religious and General Literary Association, the Council have the satisfaction of informing its members, as upon former anniversaries, that the progress of the Institution has been steady and certain, though perhaps not so rapid as might have been wished. The number of honorary members will be found to have slightly decreased; nevertheless there has been an increase in the gross number of subscribers.

"The course of lectures delivered during the past season have, by their high character, fully realised the promises of the Council to make additional efforts in this department of the Institution. Many gentlemen from a distance have given instructive and interesting lectures on various subjects in history, literature, and science; and the clergy and gentlemen of Carlisle have most readily lent their assistance in the amusement and instruction, not only of the members of the Society, but also of those strangers who kindly favoured the Society with their attendance.

"Notwithstanding the additional attraction offered, the Council have to regret the want of general support given to the lectures, by which they have been embarrassed with a debt of upwards of £30, in consequence of which the Council feel unable to enter into any expense on behalf of the lectures for the ensuing season; they will therefore be confined to those for which no expense is incurred. Under these circumstances, the Council propose to restore rule eight to its original form, giving subscribers the privilege of introducing friends to all lectures.

"It is also with great regret that the Council have to report that the state of the evening classes is anything but encouraging. The music class is the only one that seems to have real life, and the progress of this is not what it should be, owing to the difficulty of obtaining a teacher.

The Council would impress upon the younger members the desirableness of having classes in connection with the Society, especially as such great inducements are now being afforded by the Society of Arts (with which this association is in union) to members of Institutions to pass examinations in different branches of education.

"The Council propose, if a sufficient number of members will attend, to commence several classes during the ensuing winter season.

"The library has been much augmented, 127 volumes having been purchased during the past year.

"A public soirée was held in the month of November for the benefit of the library, by which, after paying all expenses, upwards of £16 was added to the funds of the Society. Thanks are due to the ladies who so kindly undertook the providing of trays, as well as to the Cathedral choir and military band, who were an important element in the amusement of the evening.

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* For a printed account of amphibious carriages, see *United Service Journal* for the year 1829, page 579, and various other publications.

"The reading room continues well frequented. The following newspapers are taken in:—*The Times*, *Morning Herald*, *Daily News* and *Globe* daily; *The Press*, *Examiner*, *Illustrated London News* and *Carlisle Patriot* and *Journal* weekly. The Reviews and Magazines are—The *Edinburgh* and *Quarterly Reviews*, *Blackwood* and *The Churchman's Magazine*; and the following weekly and monthly publications—*Journal of the Society of Arts*, *Punch*, and *Athenæum* weekly; and *The Leisure Hour* and *Household Words* and *Narrative* monthly. Any donations, either to the library or reading-room would be most thankfully received.

"The Council beg to acknowledge with thanks the following donations:—John Nanson, Esq., *Church Missionary Intelligencer*, and *Christian Observer* monthly; Geo. Head Head, Esq., V.P., *The Warder* newspaper weekly; Wm. Brown, Esq., *The Bulwark* monthly; Mr. Sargent, *The Sentinel* weekly; Mr. Perring, *The Oxford University Herald* weekly; and to Mr. Head for an exceedingly valuable donation of books.

"The Council feel that it would be superfluous to make more than a passing allusion to the loss which this Institution shares with the whole diocese, that of its beloved and respected patron. It is with great satisfaction that the Council announce that his successor, the Hon. and Right Rev. the Lord Bishop of Carlisle, has kindly consented to occupy the same place of patron to the Institution.

"In conclusion the Council beg to represent that the only means by which this Society can be brought to occupy the full sphere of usefulness for which it was planned, is by the united and individual exertions of all its well-wishers: especially at the present time, there is a great need of a united effort for its support. As a Society of this description is a valuable ally to the Church, by supplying to its younger members sound religious instruction, as well as secular information and recreation, the Council earnestly hope that all the members, both clerical and lay, will exert themselves in disseminating the true principles and objects of this Society, and in obtaining additional subscribers, especially among young men."

By the account subjoined to the report, it appeared that the receipts had been £34 less than the expenditure. The Vice-chairman and the Council for the ensuing year were then elected. A lengthened discussion took place with reference to the propriety of altering some of the rules of the Society, and motions for that purpose were proposed but none of them were passed.

LEWES.—The following lectures have been delivered at the Mechanics' Institution during the spring session of 1856:—Jan. 10, "The Waldenses," by the Rev. T. Fisher; Jan. 17, "Female Character, as Delineated by English Poets," by Mrs. Balfour; Jan. 24, "Oxygen and Hydrogen" by Mr. John Banks; Feb. 7, "Moore's Melodies and Shakspeare's Songs," by Mr. Geo. Barker; Feb. 21, "Franklinic Electricity," by Mr. C. A. Wells; Feb. 28, "Longfellow's Excelsior," musical entertainment by Mr. Geo. Barker; Mar. 6, "An Evening with Thomas Hood," by Mr. W. Parsons; Mar. 20, "What is Chemistry," by H. W. Witte, M.C.S.; April 21, "The Trans-Circassian Campaign," by Laurence Oliphant, Esq.; May 13, "Siege of Kars," by Dr. Sandwith; June 3, "The Eastern Question," by Viscount Pevensey. At the quarterly meeting, held May 21, the report of the committee was read, showing the affairs of the Institution to be in a very satisfactory state, the number of members on the 1st of May being 306, the highest number ever on the books. The financial statement was also satisfactory. After paying all the arrears for the extensive repairs done at the end of last year, and all the current expenses, there was a balance, which will be appropriated to the purchase of books.

MANCHESTER.—The inauguration of the Mechanics' Institution will take place on Tuesday, the 9th September. The doors will be open to the holders of season-tickets at two p.m., the visitors assembling in the great lecture hall; and at half-past two an organ voluntary will give note of preparation, for one or two sacred choruses will be sung, followed by the National Anthem. An opening address will then be delivered by Oliver Heywood, Esq., president of the Institution; after which the president and the directors will accompany the invited guests through the various rooms, explaining their probable destination and uses. For the evening meeting the Theatre Royal will open its doors at half-past seven, and at eight o'clock the proceedings will commence; Oliver Heywood, Esq., presiding, and various distinguished friends of education and of the Institution addressing the meeting. To the other attractions of the exhibition, which now nearly fills the new building, will be added forthwith a very magnificent contribution of the Emperor of the French, consistingof some of the choicest productions of the far-famed imperial manufactories of Sèvres (porcelain), the Gobelins (tapestry and carpets), and Beauvais (embroidered fabrics), to the aggregate value of 109,097 francs, or about £4,400.

ROYSTON.—At the Institute, on Tuesday, 29th of July, the Rev. I. H. Gurney, rector of St. Mary's, Marylebone, delivered an interesting lecture on "Missionary Heroes." On Tuesday, 26th ult., Dr. Trevethan Spicer delivered a lecture on "Æsthetics." He treated the subject comprehensively, exposed the results of our defective methods of education, and held up to admiration the system of Æsthetic culture pursued by ancient Greece. On Wednesday, 27th ult., Dr. Spicer also delivered a lecture on "Architecture, from the Earliest to the Present Times." He spoke of the origin of the various styles, and in doing so showed the close connexion which exists between nature and art. The above lectures afforded much gratification to the members and friends of the Institute.

ADDERLEY-PARK (near Birmingham).—On Saturday the land recently appropriated by Mr. Adderley, M.P., in the neighbourhood of Saltley, as a "people's park," was, for the first time, thrown open for that purpose, when the occasion was celebrated by a dinner and other becoming festivities. At one o'clock the provisional committee of management assembled at the Market-hall, in Belmont-row, and, accompanied by some thousands of artisans, and headed by a band of music, proceeded to inaugurate the park. In the procession were Lord Lyttelton, Mr. Adderley, M.P., Mr. C. H. Bracebridge, Mr. Hodgson, the Mayor of Birmingham, Mr. J. Walsh, numerous members of the corporation of the borough, the Coleshill troop of Yeomanry, of which Mr. Adderley is the captain, and a number of gentleman residing in the neighbourhood. The park, which is pleasantly situated contiguous to the Saltley Training College, and about two miles from the centre of Birmingham, was fitted up with capacious tents for dining, concert, dancing, &c. At the dinner Mr. Adderley, M.P., presided. Mr. Adderley explained that his sole object in giving the park was to bestow on the working-classes a healthy locality in which they and their families might enjoy the benefits of fresh air and exercise. The affairs of the park, he observed, were now managed by a committee of operatives, but so soon as a sufficient number of subscribers was obtained to defray the small amount of annual expenses which would be necessarily incurred, a committee from among the subscribers would be appointed, and he would then convey over the land in perpetuity upon a mere nominal rental. After dinner, the cricket-ground, the dancing-tent, and the concert afforded ample amusement for the people, who enjoyed a very agreeable afternoon, the greatest decorum having prevailed throughout.

Miscellanea.

THE LIVERPOOL FREE LENDING LIBRARIES.—The success which has attended the formation of the free lending libraries in Liverpool is quite unprecedented, and their increasing usefulness is becoming daily more and more apparent. At present the issues average upwards of 4,500 volumes per week. The care which is taken of the books and the punctuality with which they are returned are remarkable; and although there have been upwards of 350,000 volumes lent since the commencement, only three or four books of trifling value have been really lost to the libraries. In the selection of books all tastes, as far as practicable, have been consulted; and the readers have now between 13,000 and 14,000 volumes to select from. The high class of reading which the statistics exhibit is most cheering, and the happiest results must necessarily flow from the establishment of such institutions.—*Liverpool Mercury.*

THE MARYLEBONE FREE LIBRARY.—The trustees of this Institution having reported, at a general meeting convened for the purpose, that although the society was able to meet its liabilities up to the end of the present year, it could not be carried on beyond that time for the want of sufficient annual subscriptions, and must therefore be closed;—some gentlemen hitherto unconnected with its management, and deeply regretting such a state of things, have formed themselves into a special committee, for the purpose, if possible, of averting that result, and continuing to the working classes and their children the intellectual advantages which they now possess. The reading rooms, which now contain 5,000 volumes, and are available to the public every day (Sunday excepted), from ten in the morning to ten at night, were opened on January 9, 1854; and from that date to July 31, 1856, 73,312 readers have attended, and 79,477 books have been issued. In addition to the reading room, a lending library, containing 1,000 volumes, established and conducted by working men themselves, is in full operation; 5,732 volumes have been taken out, none of which have been lost, nor has any case of wilful damage occurred. About £200 in addition to the present annual subscription, will be sufficient to prevent the closing of the Institution.

ELECTRO-CHEMICAL ENGRAVING.—M. Derincenzi, a French inventor, has spent some years in the development of an ingenious plan of producing relief printing plates by an electro-chemical process. The metal he employs is zinc, in thin sheets, which are grained with sifted sand, and the design is made upon them with lithographic ink and pen. When the design is finished, it is prepared as if for the lithographic press. For this purpose, the plate is plunged into a decoction of nut galls for a minute. It is washed in pure water, and gummed with a weak solution of gum-arabic. The plate is moistened with a sponge, the design touched with essence of turpentine, and a lithographic cylinder coated with a varnish rolled over the surface. This varnish covers exactly all the lines made by the designer. The varnish should have the following qualities:—1st, of not altering the design; 2nd, of adhering strongly to the plate: 3rd, of not being attacked by the chemical agents used to engrave it. The varnish known in England as *Brunswick Black*, mixed with oil of lavender, is preferable to all others. It is composed of asphalte varnish, linseed oil boiled with litharge and turpentine. When the varnish is dry, the zinc plate is put in connection with a plate of copper, at a distance of one-fifth of an inch, and plunged into a solution of sulphate of zinc, marking fifteen degrees; thus a voltaic couple is formed, and the sulphuric acid dissolves all the uncovered parts of the zinc. More or less depth is given to the engraving, according to the nature of the design. Pencil drawings are generally engraved in four or five minutes, pen drawings in from seven to ten minutes. The sulphate of copper produces no alteration in the most delicate lines, and does not attack the varnish. This mode of engraving may be applied to any other process by which a design is reproduced. The drawing may be made upon paper, and transferred upon the plates. Impressions from lithographic stones, from copper, or steel, may be transferred. Graving tools may also be used as well upon the zinc as upon lithographic stones, for the purpose of producing a flat shade. This process is equally applicable to printing type. It is sufficient to have a page of a book transposed upon a plate of zinc to make a stereotype. The inventor asserts that his process will supplant the common one of stereotyping. By it, a page of a book may be transposed during printing, upon thin sheets of zinc, and from these, upon stouter sheets, for engraving, whenever a reprint of a published work is demanded.

THE EXPORT TRADE IN JOINERY.—The official statistics of the export trade in these articles show the following facts connected therewith. These goods are entered at value only, and do not include iron and zinc houses and stores, &c., and window glass. They comprise wooden house frames, fittings, joiners' work, &c., and in 1854, amounted in value to £87,562, distributed to the following countries:—£1,240 to Turkey; £2,225 to the Western Coast of Africa (British and foreign); £248 to Buenos Ayres; £83,032 to Australia; £396 to the West India Islands and British Guiana; and £421 to other countries. The amount was not so large as in the previous year, when it reached £112,512. There was also shipped in 1854, wooden wares of various kinds, amounting in value to £101,279. If to this be added some 22,000,000 or 25,000,000 bricks shipped, of the value of £65,000, or thereabouts; £63,211 for cement; £60,000 for window glass; £366,488 for painters' colours; £66,000 for paper hangings; £31,000 for carts and waggons; and £178,000 for other carriages,—a total value is shown of upwards of a million sterling, of articles in which the building trade are concerned.

CULTIVATION OF COTTON IN ALGERIA.—The growth of cotton in Algeria forms the subject of a rather interesting report from Marshal Vaillant to the Emperor, which appeared in Friday's *Moniteur.* In this document the minister of war recognises the good effect of the decrees of the 16th of October, 1853, by which an annual prize of 20,000f. was allotted, for five years, to the best cotton grower in the Franco-African colony; and for three years, commencing with 1854, the whole cotton produce of Algeria was ordered to be purchased by the state at a price fixed beforehand, and advantageous to the prodoucer. In consequence of this encouragement, the growth of cttton has increased, and it has been proved not only that the plant flourishes in many districts of the colony, but that its quality is comparable to that of the finest produce of the United States. A prolongation of the advantages assured to the producer is suggested. and it has accordingly been decreed that the government will continue to purchase the whole of the Algerine cotton until the crop of 1858 inclusively. It may not be uninteresting to our manufacturers to watch the progress of this fresh field, which, judiciously nurtured by the French government, may, perhaps, ere very many years have passed, compete for their custom with the vast cotton grounds of the States. It is yet too soon to risk a prediction as to what Algeria may do in this way; but present appearances are favourable, and doubtless France will neglect no means of converting into a profitable colony a territory which has hitherto served but as an expensive training ground for her soldiers.

HOW MUCH IS A BUSHEL OF WHEAT?—The inconvenience attending the want of some uniform measure in the provincial corn markets of England may be illustrated in a single sentence. When our rural friend Giles disposes of his stuff in Newcastle-on-Tyne he knows that a bushel of wheat means 63lb.; but should business ever lead him to Gloucester, he finds that the bushel of wheat there means only 60lb. At Birmingham he would observe that the variation amounts to no more than a single pound, the Birmingham bushel being 62lb.; but, on the other hand, at Liverpool he will find to his cost that his bushel must contain 7lb. more than the bushel he has been accustomed to use in Newcastle—the Liverpool bushel of wheat is 70lb. Then, though there is only a single pound of difference between the Birmingham bushel of wheat and the Newcastle bushel, there is actually 7lb. of difference in the bushel of barley. At Newcastle this measure is 56lb., whereas at Birmingham it is only 49lb.

CONTRIVANCE FOR MILKING COWS.—A machine is said to have been invented in America, by Mr. H. A. Reeves of New York State, for milking cows. The milking is done by means of a crank attached to a shaft, on which there are four elastic arms of steel, the ends of which are furnished with rollers. On one side of the ring within which the rollers move, there is an elastic pocket, into which the animal's teat is placed. The back of this pocket is stiff so that when the rollers revolve they will come in contact with the front part of the pocket and press it with the teat against the back part. The teat thus pressed is relieved of its milk, which flows down through the pocket, and through the hollow case of the instrument into a tube, and thence into the milk pail. Its size is convenient, and its cost not great. The inventor thinks that cows may be milked much quicker by this contrivance than by hand. Neither the hand of the operator nor the teats of the cow are liable to be made sore, as they are when the pressure of the hand is continually applied. If desirable, the instrument may be made with two pockets, so as to milk two teats at a time.

GAS IN OMNIBUSES.—The *Independance Belge* states that the omnibuses and dilligences in the neighbourhood of Lyons have adopted the use of portable gas, which is carried in a cylinder under the feet of the coachman, and communicates by means of a pipe with a lamp inside the vehicle.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August* 29*th*, 1856.]

Dated 3rd May, 1856.

1052. Evan Thomas, Holywell-street, Millbank—Improvements in the construction of counting apparatus, for ascertaining and indicating the number of rotations made by shafts or spindles in various descriptions of machinery.

Dated 5th June, 1856.

1344. Duncan Campbell Dallas, Islington—Improvements in chemical preparations applicable to the photographic and photo-galvanographic processes.

Dated 23rd July, 1856.

1748. Henry Doubleday, Coggeshall, Essex—An improvement in the manufacture of starch.

Dated 30th July, 1856.

1802. Richard Archibald Brooman, 166, Fleet-street—Improvements in ladies' skirts or petticoats, and dress-improvers or bustles. (A communication.)

Dated 2nd August, 1856.

1828. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of artificial fuel. (A communication.)

1830. Josiah Rhodes, Holborn Brass Foundry, Nottingham—Improvements in machinery or apparatus for reducing turnips and other vegetable substances to a pulpous state.

Dated 4th August, 1856.

1832. Josiah Harris, Dolgelly, Merioneth, N.W.—An apparatus for collecting and condensing smoke and gases generated in furnaces.

Dated 7th August, 1856.

1861. Alexandre Théodore Nicolas Goll, 57, Rue de Brétagne, Paris—An improved button.

1863. Samuel King, Brighton—Improvements in spirit lamps.

1865. Charles Wright, 20 and 21, Green-street, Southwark—Improvements in the preparation of lubricating materials.

Dated 8th August, 1856.

1867. Joseph Leese, junr., Manchester—Certain improvements in machinery used for printing calico and other fabrics.

1869. Thomas Austen, Waltham Abbey, Essex—A machine for ascertaining the propelling force of gunpowder.

1871. William Edward Newton, 66, Chancery-lane—Improvements in machinery for composing and distributing types. (A communication.)

1873. Diederich Fehrman, Liverpool—Improvements in lamps adapted for burning resin oil. (A communication.)

Dated 9th August, 1856.

1875. William Webster, 22, Bunhill-row—An improved valve-cock. (A communication.)

1877. Emile Kopp, Paris—Improvements in the manufacture of gas.

1879. Eugene Ernest Amyot, Paris—Improvements in the preparation of pulp for paper, pasteboard, and other uses for which pulp is required.

1881. Archibald Lockhart Reid, Glasgow—Improvements in producing ornamental figures or devices on textile fabrics and other surfaces.

1883. George Anderson, 22, Queen's-road, Dalston—Improvements in the construction of taps or valves for regulating the passage of gas.

Dated 11th August, 1856.

1885. John Cartland, Birmingham—A new or improved door spring.

1887. Richard Archibald Brooman, 166, Fleet-street—An improved fermenting agent. (A communication.)

Dated 12th August, 1856.

1889. Armand Rieupayroux Janet, Perigueux, France—A certain apparatus for taking measure of coats.

1891. Joses Weaver Downing, Birmingham—Improvements in the manufacture of metallic and other wheels and pullies.

1893. John Hardaker, Leeds—Improvements in machinery or apparatus for stopping railway trains, which are also applicable for alarm signals generally.

Dated 13th August, 1856.

1895. Richard Dugdale Kay, Accrington, Lancaster—Improvements in machinery or apparatus for washing, scouring, cleaning, preparing, dyeing, or finishing woven fabrics, yarns, or threads. (A communication.)

1897. Jean Baptiste Clara, 39, Rue de l'Echiquier, Paris—Certain improvements in producing and employing steam and the gaseous products of combustion for obtaining motive-power.

Dated 14th August, 1856.

1899. Edward Hallen, Cornwall-road, Lambeth, and William Holland Kingston, Bandon, Ireland—Improved means for making signals on railways.

1901. John Knowles, Holcombe Brook, Lancashire, and William Clarke, Manchester—Certain improvements in looms for weaving.

1903. William Morgan, 48, Gloucester-terrace, Hyde-park—Improvements in the manufacture of guns and mortars.

1905. Peter Augustin Godefroy, 3, King's Mead-cottages, New North Road, Islington—An improved treatment of the matrix of rock quartz and all like substances, for the extraction of auriferous, argentiferous, and other metals contained therein.

Dated 15th August, 1856.

1908. Henry Columbus Hurry, Wolverhampton—Improvements in railway crossings.

1910. Col. Stephen Szabo de Kis-Geresd, Widnes, Lancashire—Improvements in obtaining motive-power.

1912. Henry Dubs, Vulcan Foundry, Warrington, and Josiah Evans, Haydock—Improvements in effecting the consumption of smoke.

Dated 16th August, 1856.

1914. William Hargreaves, Bradford—Improvements in Colliers combing machine, in combing wool, hair, cotton, silk, flax, and other fibrous substances.

1916. David Chalmers, Manchester—Improvements in looms for weaving.

1918. Alfred Hodgkinson, Springfield Bleach Works, Belfast—Improvements in bleaching, scouring, and cleansing plain and embroidered fabrics.

1920. Philippe Pierre Hoffmann, Strasbourg—An improved compound to be used for waterproofing fabrics, paper, leather, or other materials.

Dated 18th August, 1856.

1922. Thomas C. Richardson, 101, Drury-lane—The process for the procuring and manufacturing the sulpho-saccharate of simarubine.

1924. William Tytherleigh, Birmingham—A new or improved manufacture of rollers or cylinders for printing fabrics.

1926. William Colborne Cambridge, Bristol—Improvements in the construction of portable railways.

1928. John Stopperton, Isle of Man—Improvements in propelling vessels.

1930. Andrew Peddie How, Mark-lane—Improvements in pumps.

Dated 19th August, 1856.

1932. James Leach, William Turner, and John Tempest, Rochdale—Improvements in rollers, applicable to condensing and all other kinds of engines, for carding wool, cotton, and other fibrous materials.

1934. Pierre Noyer, 38, Gerrard-street, Soho—Winding up fusee watches and pocket chronometers, and setting the hands without key.

1936. Henry Burden, Troy, New York, U.S.—Improvements in machinery or apparatus for manufacturing shoes for horses, mules, and other animals.

1938. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

1940. James Apperly, Dudbridge, Gloucestershire—Improved machinery for carding wool or other similar fibrous substances.

1942. Anthony Charles Vetter de Doggenfeld, Trinity-square, Brixton—Improved glass ornaments for ornamenting gardens, summer houses, dinner and other tables, and for other ornamental or decorative purposes.

Dated 26th August, 1856.

1944. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in roller fulling mills. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

Sealed August 29th, 1856.

528. John Reading.
531. Paul Rapsey Hodge.
534. Ferdinand Kasclowsky.
550. Charles Thomas Rosenberg.
551. Martin Samuelson.
555. Richard Dugdale Kay.
591. Henri Petitpierre.
594. George Spencer.
612. Thomas Porter.
661. Charles Frederick Parsons.
662. Richard Archibald Brooman.
664. Peter Armand le Comte de Fontainemoreau.
669. John Trueman.
728. William Edward Newton.
1201. Alexandre Henri Dufresne.
1337. Alexandre Louis Gibon and André Frohlich.
1492. Alexander Keiller.

Sealed September 2nd, 1856.

539. Adolphus Oppenheimer.
554. Samuel Clegg and John Kay.
556. William Billinton.

Patents on which the Third Year's Stamp Duty has been Paid.

August 25th.

2001. Edward Patrick Gribbon.

August 26th.

2000. Joseph Cundy.
2002. Peter Armand le Comte de Fontainemoreau.
2029. John Tayler, James Griffiths, and Thomas Lees.
2100. John Ward and Edward Cawley.

August 27th.

2102. William Edward Newton.

August 28th.

2004. John Henry Johnson.
2060. Weston Grimshaw and Ellis Rowland.

August 29th.

2008. Charles Goodyear.
2009. Charles Goodyear.
2010. Joseph Cundy.

August 30th.

2013. William Edward Newton.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3871	Sept. 1.	Nail and Corn Trimmer	John Broad	Wolverhampton.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 12, 1856.

PARIS IMPROVEMENTS.

(*Concluded from page* 684.)

3.—Rules for the Determination of the Compensations.

The jury decides upon the *bonâ fide* nature and tenor of such deeds as may tend to affect the amount of compensation.

In case the "administration" disputes the right of compensation, the jury takes no cognizance of the dispute, which is remitted for adjudication to the proper tribunals, but nevertheless determines the amount of the compensation, just the same as if it were due, and the presiding judge orders the payment of the sum to the suitors' fund[*] until the question is decided.

If the purchase of a portion of certain buildings is necessary for the sake of public advantage, the whole must be bought, if the owners require it at the hands of the jury, and formally declare such to be their intention within certain legal periods.

The case is the same whenever any portion of land is reduced, in consequence of division, to one quarter of its original extent, and if the owner does not possess any adjacent grounds, or the reduced portion does not exceed ten ares.[†]

If the intended works are likely to have the effect of giving an immediate and special increase of value to the remnant of the property, that increase is taken into consideration in valuing for the compensation.

Buildings, plantations, and other improvements give no claim to compensation when, looking at the period at which they were made, or from other circumstances, the jury are satisfied that they were undertaken with a view of claiming a higher compensation.

If the parties refuse to abide by the decision, possession is taken of the property, after due payment of the monies in the suitors' fund.

No payment is made whenever the property is mortgaged or liable to other incumbrances. In such cases the monies due by the "administration" are paid over to the suitors' fund, to be distributed among the creditors, according to the rules of law.

If in the course of six months after the order for taking possession is awarded, the administration does not take proceedings for having the amount of compensation determined, the parties may do so for themselves.

When the question of compensation has been settled, if it be not paid to the owners or to the suitors' fund within the six months ensuing the jury's verdict, legal interest shall be due from the day on which the six months expire.

4.—Sundry Regulations.

If the lands purchased for public works are not used for that purpose, the original owners or their representatives may petition for the recovery of their property.

The price of lands thus coming to be re-sold may be settled by agreement; if, however, the parties cannot come to an agreement, the affair is brought before the jury to be settled in conformity with the above rules. In no case whatsoever is the jury at liberty to fix a price of re-sale higher than that at which the lands were previously purchased.

When the "administration" intends to act in this way, it gives due notice thereof through the usual means of publicity, and a period of three months is allowed to the original owners to make known their determination.

Contractors for public works have the same rights as the public administration, and are liable to the same obligations.

5.—Compulsory Possession in Cases of Urgency.

When it becomes necessary to enter upon possession of lands not built upon, the necessity for immediate possession is proclaimed simply by a decree or ordinance.

When this takes place after judgment for possession has been given, the decree relative to the necessity of the case, together with the legal decision, are both notified to the owners and possessors of the lands, who are summoned to appear before the civil court. The summons allows at least a delay of three days for appearing in court, and must certify the amount of the offers made by the "administration."

On the day fixed upon by the writ of summons, the owner and possessors of the lands are bound to make known the amount of their claims, previous to taking possession of the property. In case of non-attendance on their part, the proceedings are continued notwithstanding their absence, and the tribunal determines the sum to be paid into the suitors' fund.

The court is empowered to go and inspect the premises, or to delegate an agent in its stead, to collect on the spot such information as may determine the value of the lands, and to draw up a report upon the whole matter. The latter operation must be gone through in the course of five days from the date on which the order was issued for that purpose.

In the course of three days after the above report has been deposited in the office, the court awards the sum which is to be paid. The latter consists not only of the principal, but likewise of such monies as shall secure the payment of interest at 5 per cent. for two years to come.

Upon being presented with the document admitting the receipt of the sum by the cashier of the suitors' fund, and a new writ of summons to appear before the end of two days, having been issued, the president gives orders for taking possession.

The court's decision and the president's order are carried into execution forthwith, and cannot be appealed from.

When possession has taken place, any of the parties may sue for the ultimate apportionment of the compensation in the legal form.

If the compensation awarded be above the sum offered, the difference between both sums is also vested in the fund previously alluded to. But this must be done in the fortnight after the jury's verdict, otherwise the proprietor has a right to stop the progress of the works.

In regard to what is termed in England *good-will*, the business done is likewise taken into consideration by the special jury in France. In such cases the claimant's books, ledgers, &c., are brought forward to test the truth of the claim, and the jury either awards the amount required, or a smaller sum, or rejects the claim altogether according to the circumstances.

The improvements now going on in Paris have naturally given rise to numerous claims of this nature. Generally speaking the parties demurred to the offers made by the municipal authorities of Paris, on the ground of insufficiency. These cases are therefore usually brought before the special jury, but the claimants are frequently either non-suited altogether, or find themselves obliged to accept of a sum far inferior to their claims.

The foregoing regulations refer to the mode of procedure in France generally. The following information applies more particularly to Paris and the late improvements there, and has been kindly furnished by Mons. Merruau, Secretary-General to the Municipality of the French metropolis.

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[*] *Caisse des Depots et consignations.* A special office, connected with the public treasury, established for receiving and administering legal and voluntary deposits, the funds of the Legion of Honour, or those belonging to the savings banks, annuities, and other sources, over which it has by law a right of superintendence. Interest accrues at the rate of 3 per cent., and is usually reckoned from the 60th day after the deposit.

[†] 1 are = 100 square metres.

1.—MUNICIPALITY OF PARIS.

The *Conseil municipal*, or municipality of Paris, has an organisation peculiar to itself, and, therefore, different from the other municipalities of the realm. This organisation existed previously to the present system of government.

Organisation.—The whole body consist of forty members, who are all named by the Emperor, and it is presided over by one of themselves, who is likewise chosen by the head of the government.

The two prefects (of police and of the department) have a right to convene the municipality and to attend its meetings; but they enjoy no right of presidency, nor do they vote.

The Secretary-General is elected by the Council.

It is by no means necessary that the mayors of the twelve arrondissements of Paris should be members of the municipality. Practically speaking, in general they are not members of that body.

The municipal sessions are of a double nature:—

1.—*Ordinary* or permanent throughout the year. This is an exception to the ordinary law of municipalities, according to which they are to meet for their sessions four times a year.

The Council is convened by the prefect of the Seine.

2.—Once a year the municipality holds an exceptional or extraordinary session. It lasts a fortnight, and the members are invested for the time being with the rights and privileges of the Councils-General in the departments.

The latter session takes place upon an Imperial decree being issued to that purpose.

The mayors, though not members of the Council, are, however, considered as forming a portion of the municipal body or corps, under their natural presidents, the two prefects. The principal reasons for their exclusion from the Council may be summed up as follows:—1. Their functions are too numerous and absorbing to allow their regular attendance at the sittings. 2. As they are rather to be considered as public registrars (*officiers de l'état civil*), than as real mayors, they may be considered more properly as the agents or delegates of the prefect. 3. Supposing them to be members of the Council by their own right, the Council would thus be formed of two sorts of functionaries, some of whom would be elected[*] for the whole period of their duties, and others either admitted or excluded according to the will of government. 4. The mayors might form a coalition, so as to secure to their views a majority in the Council. 5. As the mayors are appointed and dismissed by the government, they might not enjoy that complete independence of opinion which is desirable in such a station. 6. It is impossible to liken the mayors of Paris to the other mayors of the realm, where they form, with their *adjoints*, a portion of the municipal Council, because it would be impossible to admit thirty-six mayors and *adjoints* into the Parisian municipality.

Functions.—This body or corporation, under the direction of the prefect, has a right to adopt the necessary measures for the municipal administration of the city. Its various objects may be grouped under the following heads:—registering of births, marriages and deaths—of electoral franchise rights—the national guard, the recruiting of the army, the assessment of taxes, public schools and popular education, the public worship, public charities, regulations for trade and commerce, the legal practice of the medical profession, burials, etc. Many of these duties are delegated to the mayors; but still the superintendence of these matters is placed in the hands of the municipal Council.

Among its functions must be likewise reckoned the police regulations, sewerage, pavement of streets and thoroughfares, inspection of theatres, distribution of water throughout Paris, preservation of the public health, and so forth.[*]

In order to fulfil these numerous duties, the Council forms a certain number of committees, to whose direction are entrusted the various branches, and to whom are sent up the reports of their sub-agents.

Finances and Revenues.—The principal source of revenue for the Paris municipality lies in the *Octroi*, or town duties paid on eatables and other articles of consumption paid at the gates of the city. This tax brings in a yearly revenue of about 40 millions of francs. To these may be added ten other millions levied upon the public in different forms and ways, which it would be of no interest to detail. Thus we come to a round sum of 50 millions.

The debts of the city of Paris amount to something near 200 millions of francs, the interest of which is partly paid in annuities, and partly in the usual way, like any other loan.

It is, however, a principle with the municipality never to incur a perpetual debt by having recourse to consolidated funds and annuities; they prefer making greater sacrifices, and drawing on a part of their yearly revenue to liquidate their debts by degrees.

Hitherto the financial position of the city has been considered as very flourishing. After every expense had been paid, and a part of the revenue allotted to the gradual extinction of their debts, they were still able to lay by a yearly surplus of seven or eight millions, as a reserve for future contingencies. When the late improvements were resolved upon, this reserve fund amounted to about 50 millions of francs (£2,000,000).

However, the revenues of the city are at present threatened with a deficit, resulting from a late measure, adopted in consequence of the scarcity which has prevailed for the last two years, itself the result of insufficient crops. A few particulars will serve to explain the latter circumstance.

The bakers in Paris form a privileged corporation, who are obliged to have a certain quantity of flour for the supply of the city, which is warehoused at the Corn Exchange. In consequence of the general prices they would have been obliged to raise the price of bread. In order to prevent the disastrous effects of this on the population, the municipality engaged to pay a monthly sum into the hands of the corporation, provided the 4 lb. loaf should be kept down at 40 centimes the lb. In order to repay this enormous outlay to which the city has bound itself (14 or 15 millions of francs), it is intended to keep up the average price higher than usual when abundant crops will allow a general fall of prices. As this measure is to be permanent for Paris, it is hoped that a reserve fund will be thus established in time for future contingencies of the same nature.

Every year the budget is drawn up by the prefect, who submits it to the approbation of the Council. Their vote can alone make it binding, and thus it becomes law for the metropolis.

2.—IMPROVEMENTS OF PARIS.

When the Imperial government resolved upon undertaking the late improvements, it applied to the municipality, in order to obtain its co-operation.

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[*] Though named by the Government, the latter chooses them from a list of candidates selected by the citizens.

[*] It must be observed that all French communes or municipalities are considered by the law as being in a state of wardship, under the guardianship of the State. Thus they cannot perform, in virtue of their own right, any act which a ward is not allowed to perform, such as buying or selling municipal lands, &c.

In regard to the Rue de Rivoli, the government offered to pay one-half of the sum for the portion running along the Tuileries and the Louvre, and one-third of the expenses for the remainder.

This was accepted, and the municipality proceeded to the acquisition of the necessary lands in the usual way, according to the general law, which has been detailed in the above pages.

In one respect, however, there was an exception to the general rule. Those mayors of Paris who were concerned in the future improvements, were induced to use their influence with their *administrés*, to dispose them to an amicable settlement of their individual interests. The efforts of the mayors have in most cases proved successful.

Previously, however, to this, the municipality contracted a loan amounting to 50,000,000 francs, which soon realised a bonus of 12 millions. Thus matters began on the part of the city, with a fund in reserve of

about	50,000,000	francs.
Loan	62,000,000	,,
Share of the government	50,000,000	,,
	162,000,000	,,
	£6,482,000	

The re-sale of grounds, and of the materials furnished by the demolitions, produced a profit over the price of purchase. There was thus no loss to the municipality.

Many claims arising out of good-will have been commonly brought before the special jury, and settled to the satisfaction of the municipality.

As the French law authorizes the special jury either to repair in a body to the spot, or to delegate one of its members for the same purpose, no expense is incurred for witnesses.

The costs for legal advice are very moderate, and regulated by the law.

Every detail concerning symmetry, architecture, and thoroughfares, is under the superintendence of the city architects, engineers, agents, &c., and executed according to their directions.

No part of the sums of money offered by the government are to be refunded.

There may be, on the other hand, two cases in which the municipality may have to pay either a very large portion, or the whole of the expenses. Of this two actual examples may be given.

The halles, or general market, has been lately pulled down, and is now in process of rebuilding. As this exclusively affects the interest and health of the city, the government has no share in the undertaking, and the expenses are paid entirely by the funds of the municipality.

But, supposing a road or large thoroughfare to be opened in the heart of the city, thus supplying a communication between one part of the Empire and another, it is considered as an imperial road of the first class, and it thus falls within the sphere of the government, consequently, the municipality is not liable to any outlay on this score. The *Boulevard du Centre*, which is to run down from the Strasburg terminus to the waterside, is an instance of the latter kind.

Again, the Imperial government intends throwing open a magnificent avenue, measuring upwards of 300 ft. in breadth, from the *Bois de Boulogne* to the *Arc de Triomphe*. A general plan of embellishment will be adopted for that part of the city, gardens laid out, &c. As the Parisian population will be greatly benefited by the realisation of these plans, the municipality has consented to come in for a share in the expenses. However, that share will not exceed one-third of the estimated costs, because improvements upon such an extensive scale are looked upon as a private gratification to the Sovereign, which the city corporation has no need to pay for.

THE MANUFACTURE OF IRON AND STEEL WITHOUT FUEL.

At the meeting of the British Association held at Cheltenham during last month, the scientific and industrial world were startled by a process, the invention of Mr. Henry Bessemer, described in a paper under the above title, read by that gentleman at one of the Sections. The process, if not absolutely perfect at present in all its details, seems destined, from what transpired in the discussion of the paper, and from investigations which have taken place since, to produce a revolution in this important branch of national industry. It was thought better to delay the publication of the process in the *Journal* until with it might be given some results of testing and experiment. Mr. Bessemer, in his paper, states that, after being for many years engaged in experimenting on this subject, until his patience was nearly exhausted, he was led to the conclusion that he could produce a much more intense heat without any furnace or fuel than could be obtained by any of the modifications he had hitherto tried, and thus he would avoid, not only the injurious action of mineral fuel on the iron under operation, but he would, at the same time, get rid of the expense of fuel. Some small preliminary trials having been made, which gave unmistakeable signs of success, Mr. Bessemer at once proceeded to carry out his plans on a larger scale, which he thus describes:—

"On this new field of inquiry, I set out with the assumption, that crude iron contains about 5 per cent. of carbon; that carbon cannot exist at a white heat in the presence of oxygen, without uniting therewith, and producing combustion; that such combustion would proceed with a rapidity dependent on the amount of surface of carbon exposed; and, lastly, that the temperature which the metal would acquire would be also dependent on the rapidity with which the oxygen and carbon were made to combine, and, consequently, that it was only necessary to bring the oxygen and carbon together in such a manner that a vast surface should be exposed to their mutual action, in order to produce a temperature hitherto unattainable in our largest furnaces. With a view of testing practically this theory, I constructed a cylindrical vessel of three feet in diameter, and five feet in height, somewhat like an ordinary cupola furnace, the interior of which is lined with fire bricks, and at about two inches from the bottom of it, I insert five tuyère pipes, the nozzles of which are formed of well-burnt fire clay, the orifice of each tuyère being about three-eighths of an inch in diameter; they are so put into the brick lining (from the outer side) as to admit of their removal and renewal in a few minutes when they are worn out. At one side of the vessel, about half way up from the bottom, there is a hole made for running in the crude metal, and in the opposite side there is a tap-hole stopped with loam, by means of which the iron is run out at the end of the process. In practice this converting vessel may be made of any convenient size, but I prefer that it should not hold less than one, or more than five tons of fluid iron at each charge. The vessel should be placed so near to the discharge hole of the blast furnace as to allow the iron to flow along a gutter into it; a small blast cylinder will be required capable of compressing air to about 8lb. or 10lb. to the square inch. A communication having been made between it and the tuyères before named, the converting vessel will be in a condition to commence work; it will, however, on the occasion of its first being used after relining with firebricks, be necessary to make a fire in the interior with a few baskets of coke, so as to dry the brickwork and heat up the vessel for the first operation, after which the fire is to be all carefully raked out at the tapping-hole, which is again to be made good with loam. The vessel will then be in readiness to commence work, and may be so continued without any use of fuel until the brick lining in the course of time becomes worn away and a new lining is required. I have before mentioned that the tuyères are situated nearly close to the bottom of the vessel; the fluid metal will therefore rise some 18 inches or 2 feet above them. It is therefore necessary, in order to prevent the metal from entering the tuyère holes, to turn on the blast before allowing the fluid crude iron to run into the vessel from the blast furnace. This having been done, and the fluid iron run in, a rapid boiling up of the metal will be heard going on within the vessel, the metal being tossed violently about and dashed from side to side, shaking the vessel by the force with which it moves, from the throat of the converting vessel. Flame will then immediately issue, accompanied by a few bright sparks. This state of things will continue for about 15 or 20 minutes, during which time the oxygen in the atmospheric air combines with the carbon contained in the iron, producing carbonic acid gas, and at the same time evolving a powerful heat. Now, as this heat is generated in the interior of, and is diffused in innumerable fiery bubbles through the whole fluid mass, the vessel absorbs the greater part of it, and its temperature becomes immensely increased, and by the expiration of the 15 or 20 minutes before-named, that part of the carbon which appears mechanically mixed and diffused through the crude iron has been entirely consumed. The temperature, however, is so high that the chymically combined carbon now begins to separate from the metal, as is at once indicated by an immense increase in the volume of flame rushing out of the throat of the vessel. The metal in the vessel now rises several inches above its natural level, and a light frothy slag makes it appearance, and is thrown out in large foam-like masses. This violent eruption of cinder generally lasts about five or six minutes, when all further appearance of it ceases, a steady and powerful flame replacing the shower of sparks and cinders which always accompanies the boil. The rapid union of carbon and oxygen which thus takes place adds still further to the temperature of the metal, while the diminished quantity of carbon present allows a part of the oxygen to combine with the iron, which undergoes a combustion and is converted into an oxide. At the excessive temperature that the metal has now acquired the oxide as soon as formed undergoes fusion, and forms a powerful solvent of those earthy bases that are associated with the iron. The violent ebullition which is going on mixes most intimately the scoria and metal, every part of which is thus brought in contact with the fluid oxide, which will thus wash and cleanse the metal most thoroughly from the silica and other earthy bases which are combined with the crude iron, while the sulphur and other volatile matters which cling so tenaciously to iron at ordinary temperatures are driven off, the sulphur combining with the oxygen and forming sulphurous acid gas. The loss in weight of crude iron during its conversion into an ingot of malleable iron was found, on a mean of four experiments, to be 12½ per cent., to which will have to be added the loss of metal in the finishing rolls. This will make the entire loss probably not less than 18 per cent., instead of about 28 per cent., which is the loss on the present system. A large portion of this metal is, however, recoverable by treating with carbonaceous gases the rich oxides thrown out of the furnace during the boil. These slags are found to contain innumerable small grains of metallic iron, which are mechanically held in suspension in the slags, and may be easily recovered. I have before mentioned that after the boil has taken place a steady and powerful flame succeeds, which continues without any change for about 10 minutes, when it rapidly falls off. As soon as this diminution of flame is apparent, the workman will know that the process is completed, and that the crude iron has been converted into pure malleable iron, which he will form into ingots of any suitable size and shape by simply opening the tap hole of the converting vessel and allowing the fluid malleable iron to flow into the iron ingot moulds placed there to receive it. The masses of iron thus formed will be perfectly free from any admixture of cinder, oxide, or other extraneous matters, and will be far more pure and in a forwarder state of manufacture than a pile formed of ordinary puddle bars. And thus it will be seen that by a single process, requiring no manipulation or particular skill, and with only one workman, from three to five tons of crude iron passes into the condition of several piles of malleable iron in from 30 to 35 minutes, with the expenditure of about one-third part the blast now used in a finery furnace with an equal charge of iron, and with the consumption of no other fuel than is contained in the crude iron. To those who are best acquainted with the nature of fluid iron, it may be a matter of surprise that a blast of cold air forced into melted crude iron is capable of raising its temperature to such a degree as to retain it in a perfect state of fluidity after it has lost all its carbon, and is in the condition of malleable iron, which in the highest heat of our forges only becomes a pasty mass. But such is the excessive temperature that I am enabled to arrive at with a properly-shaped converting vessel and a judicious distribution of the blast, that I am enabled not only to retain the fluidity of the metal, but to create so much surplus heat as to re-melt the crop-ends, ingot runners, and other scrap that is made throughout the process, and thus bring them without labour or fuel into ingots of a quality equal to the rest of the charge of new metal. For this purpose a small arched chamber is formed immediately over the throat of the converting vessel, somewhat like a tunnel head of the blast furnace. This chamber has two or more openings on the sides of it, and its floor is made to slope downwards to the throat. As soon as a charge of fluid malleable iron has been drawn off from the connecting vessel, the workman will take the scrap intended to be worked into the next charge, and proceed to introduce the several pieces into the small chamber, piling them up around the opening of the throat. When this is done he will run in his charge of crude metal, and again commence the process. By the time the boil commences the bar ends or other scrap will have acquired a white heat, and by the time it is over most of them will have been melted and run down into the charge. Any pieces, however, that remain, may then be pushed in by the workmen, and by the time the process is completed they will all be melted, and ultimately combined with the rest of the charge, so that all scrap iron, whether cast or malleable, may thus be used up without any loss or expense. As an example of the power that iron has of generating heat in this process, I may mention a circumstance that occurred to me during my experiments. I was trying how small a set of tuyères could be used; but the size chosen proved to be too small, and after blowing into the metal for one hour and three quarters, I could not get up heat enough with them to bring on the boil. The experiment was therefore discontinued, during which time two-thirds of the metal solidified, and the rest was run off. A larger set of tuyère pipes were then put in, and a fresh charge of fluid iron run into the vessel, which had the effect of entirely remelting the former charge; and when the whole was tapped out it exhibited, as usual, that intense and dazzling brightness peculiar to the electric light." * * * * *

"Before concluding these remarks, I beg to call your attention to an important fact connected with the new process, which affords peculiar facilities for the manufacture of cast steel.

"At that stage of the process immediately following the boil, the whole of the crude iron has passed into the condition of cast steel of ordinary quality; by the continuation of the process the steel so produced gradually loses its small remaining portion of carbon, and passes from hard to soft steel, and from soft steel to steely iron, and eventually to very soft iron; hence, at a certain period of the process, any quality of metal may be obtained; there is one in particular, which by way of distinction I call semi-steel, being in hardness about midway between ordinary cast steel and soft malleable iron. This metal possesses the advantage of much greater tensile strength than soft iron; it is more elastic, and does not readily take a permanent set, while it is much harder, and is not worn or indented so easily as soft iron; at the same time it is not so brittle or hard to work as ordinary cast steel. These qualities render it eminently well adapted to purposes where lightness and strength are specially required, or where there is much wear, as in the case of railway bars, which from their softness and lamellar texture soon become destroyed. The cost of semi-steel will be a fraction less than iron, because the loss of metal that takes place by oxidation in the converting vessel is about 2½ per cent. less than it is with iron; but, as it is a little difficult to roll, its cost per ton may fairly be considered to be the same as iron; but, as its tensile strength is some 30 or 40 per cent. greater than bar iron, it follows that for most purposes a much less weight of metal may be used, so that taken in that way the semi-steel will form a much cheaper metal than any that we are at present acquainted with."

"In conclusion, allow me to observe, that the facts which I have had the honour of bringing before the meeting have not been elicited from mere laboratory experiments, but have been the result of working on a scale nearly twice as great as is pursued in our largest iron works, the experimental apparatus doing 7 cwt. in 30 minutes, while the ordinary puddling furnace makes only 4½ cwt. in two hours, which is made into six separate balls, while the ingots or blooms are smooth even prisms, 10 inches square by 30 inches in length, weighing about equal to 10 ordinary puddle balls."

The advantages claimed by Mr. Bessemer, irrespective of greatly diminished labour, time, and cost of production, are ingots of malleable metal, free from the hard and steely parts found in puddled iron, pure and homogeneous in quality, requiring less rolling for development of fibre, inasmuch as there is no cinder to be expressed. The size of the ingots, too, enables merchant bar or rails to be formed without welding numerous separate pieces together, as is the case at present, owing to the limited size of the puddle balls. A simple inexpensive mechanical and chemical process is substituted for "puddling," probably the hardest and most severe labour to which the human frame is subjected. Whether all the qualities which Mr. Bessemer claims for his process can be established, experience alone can show. Enough, however, has been done to make it clear that the iron industry of the country can no longer be conducted on its present system. A great change is at hand.

Subsequently to the reading of the paper, the process has been put to a practical test on Mr. Bessemer's premises, Baxter-house, St. Pancras-road, in the presence of several ironmasters, practical engineers, and scientific gentlemen resident in London, including several members of the Society of Arts.

In conducting this experiment, 6 cwt. 3 qr. 18 lb. of molten iron from a furnace were poured into the fire-brick vessel, already described, at 12 minutes past 1 o'clock, the blast having been applied at a pressure of about 8lb. per square inch, and continued until 27 minutes past 1. The mass of metal began to boil up, and the cinders and other impurities were extruded from the top of the vessel by two apertures provided for the purpose. Showers of brilliant sparks were thrown off during this process, which lasted several minutes, and as the object was to produce a mass of cast steel, rather than continue the process to the extent necessary for making pure iron free from carbon, the vessel was tapped at 36 minutes past 1 o'clock, and the contents drawn off. Small specimen ingots being first taken, the general mass was run into an ingeniously contrived mould concealed in the floor in front of the apparatus, and, after remaining there a few minutes, cooling down, it was raised out of the mould in a red-hot state, and placed upon a weighing machine. The ingot thus produced, with the two specimen ingots, weighed 6 cwt. Without the aid of fuel this mass of material was converted in 24 minutes from crude cast iron as it comes from the blast furnace into steel.

The experiment was considered by those present as extremely satisfactory.

Mr. Bessemer states that hitherto the finest qualities of iron have always been imported from Sweden and Russia, and these are now sold in this country from £20 to £30 a-ton; but, by the new process, iron can be manufactured, of equal quality, at a cost of £2 per ton less than the present cost of common English iron. If this statement be borne out by the experience of his invention, England will no longer be dependent on the foreign market for the production of iron of the finest quality.

Mr. James Nasmyth, himself the inventor of a process for passing a blast of steam through the molten crude iron, has expressed his opinion of the enormous value of the process, which, in a letter to the *Times*, he says, promises to establish "a new era in a most important branch of our manufactures;" whilst Mr. Bessemer has, with great candour, publicly admitted, before the members of the mechanical section of the British Association, at the late meeting at Cheltenham, that it was this process that has led him to his invention.

Mr. W. Bridges Adams, in a letter to the *Times*, says that there are four patents bearing on this question.

Walker and Warren, dated May, 1853, who claim "a moveable containing vessel, or furnace, employed for the purpose of agitating and consequently "puddling the liquid metal;" that is to say, the metal while in agitation is exposed to the lambent action of flame, air, or gases.

James Nasmyth, May, 1854.—The claim in this is for forcing steam or water through a hollow stirring-rod into the body of molten iron, whereby the steam will be "reduced to its elements and yield oxygen."

Joseph Gilbert Martien, of New Jersey, September, 1855.—The claim is "for purifying iron from a blast furnace, or a refinery furnace, while still in a melted state, as herein described."

Mr. Martien, in his provisional specification, says, that his invention consists "in the application of atmospheric air by mechanical pressure, or of water, vapour of water, or steam (more especially steam) below the surface of the said melted metal as it comes from a blast or smelting furnace or finery fire, so as completely to search and penetrate every part of the said metal. It may be necessary under some circumstances to continue the heat for a time to the liquid or melted metal for the more effectual treatment by the action of atmospheric air, water, vapour of water, or steam, or either. * * * It may then be conducted, after such treatment, directly, and without material loss of heat, to a reverberatory or other furnace or furnaces, and there subjected to intense heat and manipulation and speedily converted into balls of malleable metal of iron and steel."

The *modus operandi* is a channel or gutter of any suitable material, but by preference of cast iron. This gutter is perforated with numerous holes. "When hot blast or cold blast is used, I prefer to connect the hollow bottom of the gutter with the air pipes used for supplying the blast, and, when steam is employed, I connect the hollow bottom of the gutter with the boiler used." Moulds or beds may be used instead of the gutter, and "the iron thus purified may be allowed to cool in the moulds, or may be run from the gutter, channel, or receiver, into a reverberatory or suitable furnace, to be highly heated therein, and may be puddled in the ordinary manner."

Henry Bessemer, January, 1856, contains several methods of aërating molten iron, but not the method used.

Henry Bessemer, March, 1856, is not yet specified, but will, no doubt, contain the actual process.

The experiments detailed in the following letter will be read with interest:—

Royal Arsenal, Woolwich, Sept. 9, 1856.

My Dear Sir,—It may interest you to hear of a few experiments made on the iron produced by Mr. Bessemer, made according to the process now so familiar to all. First, as to mechanical tests—

1. A mass of iron, about 15 inches long by 6½ square, made from Blaenavon pig, just as it came from the iron mould into which it had been poured, was heated in the scrap forge, and reduced to a conveniently-sized "bloom" under a one-ton Nasmyth hammer. The appearance of the fracture of this mass, before heating, was similar to that usually described, viz., crystalline, porous, and of a brilliant lustre.

2. The bloom worked very stiff and rigid, and when sufficiently reduced was passed through the rollers, and made into a bar 2 inches wide by 5 thick. Cut with the shears when hot, a good incision was made to about one-third of the thickness, and the remainder fractured in the operation. Another portion of the same bloom was hammered into a short inch square bar under the same hammer, and when cut hot presented the same result.

3. When cold, the first-named bar, once hammered and once rolled, had a nick cut all round, and was broken short off on receiving a blow with a hammer. The fracture clean, laminated as if the crystals were squeezed by the pressure into horizontal layers; no fibre.

4. The two portions faggotted, heated, and hammered into a cylinder of 1 inch diameter; nicked all round, broken with a blow, a clean fracture, no fibre, the first crystalline appearance *restored*, as if the crystals had been simply pressed back by hammering in a direction contrary to the first.

5. The two portions faggotted, heated, and hammered to the same dimensions, a slight nick made on *one* side, fractured by a blow, with the same result. Impressions of the fractured ends were taken in lead, and when compared, at each fracture, had the same appearance, with no increase of fibre.

6. One portion of the last made bar accurately turned, and placed in the machine for testing the tensile strain. A portion of the fracture had an oxidised appearance, which portion was the first to give way, and without appreciable elongation. The iron worked harsh and rigid under the hammer, but well and pleasantly in the lathe. My experiments having been generally with cast iron, I regret not having many with wrought iron for comparison, but you will easily supply them.

The diameter of the specimens at the line of breakage = ·6-inch.

The breaking weights are the means of two specimens, except in that by Bessemer's process, one only being tested.

NATURE.		Breaking weight in lbs. per square inch.	Elongation before fracture.	Diminution of diameter before fracture.	REMARKS.
			Inch.	Inch.	
Wrought iron made from	Magnetic ore of Londonderry, Nova Scotia	66,491	.109	.123	Fibrous fracture.
	Catalan bloom, hæmatite and specular ore of Londonderry, Nova Scotia	59,594	.332	.199	Ditto.
	Magnetic ore of Nictau.	67,906	.282	.146	Ditto.
	Shell ore of Nictau......	61,039	.234	.204	Ditto.
Bessemer's process (heated and rolled once, heated and hammered 4 times,) preserving the *laminated* appearance to the last......		65,999	.113	.014	Crystalline partially oxidised.

Chemical Analysis.—A portion of the ingot, taken before making the bloom, selected with great care from a solid inner portion of the mass, so as to avoid cavities, fissures, or fused portions of oxide of iron, &c., was submitted to examination. No silicium whatever was detected. No trace of graphite, or of uncombined carbon. Combined carbon not exceeding 0·3 per cent. Phosphorus 0·44 per cent. Sulphur 0·056 per cent. A similar result was obtained some months ago from a sample produced by the same process by Mr. Bessemer, from another description of iron. Blaenavon iron is comparatively free from these last impurities. For comparison, a pig was taken at random from a heap of Blaenavon iron, which yielded to the same treatment the following comparable result:—Phosphorus, 0·48; sulphur, 0·062.

It appears, therefore, that while the uncombined carbon and silicium had been completely removed by the oxidising process (their oxidisation being probably almost concomitant), the complete removal of the combined carbon is a matter of greater difficulty, and that the phosphorus and sulphur are but little affected. It would appear that when disseminated in small quantities, in a combined state, through large masses of metal, they are difficult of oxidisation, and require longer treatment. It is an interesting question as to how long this treatment may be continued before the mass becomes viscid. In the act of pouring it into the mould, considerable quantities rapidly take up their appearance on the sides of the funnel, as if the tendency of the process was to induce that state. I merely mention this for consideration, and not as supposing the matter is so near complete elucidation that anything definite can be pronounced.

It may be remarked generally that the above results are only applicable to iron treated in *one* way, *i.e.*, to a *certain* iron which has remained a *certain* time under peculiar treatment. Experiments, accurately made, will show whether *time* is not an important element, that is, when the process must be stopped. As regards the iron made under the above conditions, the experiment is so far useful, if these are recorded. But nothing can be said about the system, as we may be entirely ignorant, as yet, of the true treatment required. On the other hand, the editor of the *Engineer*, Sept. 5th, states:—"We may state that we have ourselves seen several specimens of the metal after being rolled, and which presented all the appearance of the best bar-iron." Such a statement from such a quarter, whose duty it is to watch over and record these important matters, enables me gladly to draw the conclusion that there is a system by which the best bar-iron can be made under this process, and perhaps he will shortly favour us with particulars.

Very truly yours,

F. E. W.

P Le Neve Foster, Esq.,
Secretary, Society of Arts.

P.S.—Since writing the above, I see in to-day's *Times* a letter from Mr. Bridges Adams, with these words:—"From that ingot has been forged at the Royal Arsenal, Woolwich, a 'bloom,' subsequently rolled into a *tough* bar 2in. by ½in., bearing all the mechanical indications of the *best charcoal iron.*" The italics are mine. This statement is so clear, that I can only suppose Mr. Adams must perhaps allude to some experiments in the Dockyard (though I cannot hear of any), because no other than the above have been made in the Arsenal.

French Model Lodging-houses.—There is some idea of undertaking a vast enterprise, which is said, according to the *Siecle*, to have received the approbation of the Government. It is, to erect, just within part of the fortifications, 2,500 houses, in groups of fifty, which would thus give fifty villages, each forming a sort of square. Each house is to accommodate six workmen's families, at a rent to each of not more than 150 francs.

METALLIC PONTOON WAGGONS.

The experiments with Mr. Francis's corrugated metal waggons, which were last week submitted for trial before the authorities of Woolwich Arsenal, have been pronounced of so satisfactory a nature, that they have expressed their decision of urging the Government to decide on their introduction for all the purposes to which they may be applied. Sir George Pollock, Sir Frederick Abbott, Major-General Brooke, Colonel Tulloch, and many other scientific officers, have expressed their opinion that if the metallic waggons were introduced into our public services, they would prove of incalculable value.

BRIDGE BUILDING.

A correspondent in the *Builder*, under the signature of "Oliver P.," writes as follows:—

"Permit me to say, in some corner of your journal, that the articles you have given on bridge foundations have led me to think whether it might not be possible even yet to construct foundations, where desired, literally imperishable.

"Now I fancy that, within a coffer-dam, a pile of *unburnt* bricks might be raised, in proper order, with breeze, treated as a clamp, of the size and form for the required foundation, to a little above the high-water mark, and *then* burnt to a heat beyond that required for bricks, so that all might *unite together*, as we sometimes see a few accidentally joined in the firing. Then the air channels might be grouted with fine concrete, to make the bed more solid, and prevent the sub-earth rising into them.

"Or perhaps our giant engineers would as readily build and burn it on a floating iron platform, and then sink it gradually; in which case the town might be saved the nuisance of the firing, by its being done elsewhere, and floated afterwards to its place.

"Now, if this be practicable, instead of placing dependence on rotting timber, or on decaying stone or rusting iron, it might be reposed in a fire-made rock that would defy both current and cannon as long as the existence of the people it serves.

"Although apart from this point, may I name another thought? I do not suppose it new; that of forming a platform in the centre of the pier, suggested by the frequently perforated arch, for a steamers' landing-place, connected by stairs with the road level of the bridge, so as to serve for either side of the water."

Colonial Correspondence.

HONDURAS INTER-OCEANIC COMMUNICATION.

SIR,—The Central American question, which at one period bore so threatening an aspect, appears to be now definitively and satisfactorily adjusted, and there is every reason to hope and believe that there will be no further agitation upon the subject. It is said that a treaty has been entered into between Great Britain and the United States, the effect of which will be a concession by the former power of Ruatan and the other islands in the Bay of Honduras, recently denominated the Bay Islands, to the Republic of Honduras, and an engagement on the part of the latter, if not actually expressed, yet clearly and distinctly understood, that they will not, as a *Government*, whatever may be the disposition of such individuals as those who constitute the Cass and Cushing genus, interfere with our rights in British Honduras, that title being attached to the whole of the country lying between the rivers Hondo and Sarstoon, besides an extent of territory inland which has never yet been properly surveyed. Perhaps it would have been better, having the example of the Clayton and Bulwer treaty before us, to have had no "understandings" in the matter, but to have had everything clearly and unmistakeably expressed.

It is also reported that the representatives of Great Britain have signed, or will sign, a convention with the Republic of Honduras, by which she agrees to give up to her Ruatan and the other islands, on condition that the constitution given to them shall not be infringed, that the administration of justice taken from the English model shall not be interfered with, and that no import duties shall be imposed upon any goods entering their ports for the purpose of raising a revenue, but only such dues shall be exacted as may be necessary for supporting and regulating harbours, and constructing and maintaining lighthouses. The inhabitants of Ruatan will, therefore, be in precisely the same position in respect to their laws, their rights and privileges, as when they were under the dominion of the British Crown; and Honduras will exercise over them as much, and no more authority, than that which was assumed by Great Britain. In addition to this "Treaty of friendship, commerce, and navigation," there is a separate article in reference to the inter-oceanic railway through the State of Honduras, projected by Mr. Squier, late Chargé d'Affaires of the United States to the Republics of Central America, which article is to have the same force and validity as if it were inserted word for word in the same treaty. This article is one of very great importance to the commercial world, should Mr. Squier's undertaking be conducted to a successful issue. A similar article, it is said, will be concluded between the Republic of Honduras and America, and also between that State and France. By that article the government of Honduras agrees, that the right of way over such road (the inter-oceanic railway), or any other which may be constructed through its territories from sea to sea, shall be at all times open and free to the government and subjects of Great Britain, for all lawful purposes whatever. It also agrees that it will not impose any tolls, duties, or charges of any kind on the transit of property belonging to the government of Great Britain, or on the public mails sent under the authority of the same, nor on the subjects of the British Crown, and also that all lawful produce, manufactures, merchandise, or other property, belonging to the subjects of Great Britain, passing from one ocean to the other in either direction, shall be subject to no import or export duties whatever, or to any discriminating tolls or charges for conveyance on any such road, and shall be secure and protected from all interruption and detention on the part of the said State. It agrees further, that any other privilege and advantage, commercial or other, which is, or may be granted to the subjects, or citizens of any other country, in regard to any such road, shall be also extended to British subjects; and she likewise engages to establish the ports at the extremities of the contemplated road as free ports, for all the purposes of commerce. In consideration of these concessions, in order to secure the construction and permanence of the contemplated road, and to secure for the benefit of mankind the uninterrupted advantages of such a communication from sea to sea, Great Britain recognises the rights of sovereignty and property of Honduras over the line of the said road, and guarantees positively and efficaciously the entire neutrality of the same so long as she shall enjoy the privileges conceded to her. And when the proposed road shall have been completed, Great Britain equally engages, in conjunction with Honduras, to protect the same from interruption, seizure, or unjust confiscation, from whatever quarter the attempts may proceed. Nevertheless, Great Britain, in according her protection to the said road, and guaranteeing its neutrality and security when completed, understands that this protection and guarantee are granted conditionally, and may be withdrawn by her, if she should deem that the persons, or company undertaking, or managing the same, adopt or establish such regulations concerning the traffic thereupon as are contrary to the spirit and intent of this article, either by making unfair discriminations in favour of the commerce of any nation or nations, or by imposing oppressive exactions, or unreasonable tolls upon passengers, vessels, goods, wares, merchandise, or other articles. The aforesaid protection, however, is not to be withdrawn without first giving six months' notice to the Republic of Honduras.

Assuming the feasibility and completion of the projected railroad, the privileges accorded by the Republic of Honduras in that state, to the government and subjects of Great Britain, are of the highest importance, and for the attainment of them the government, it can hardly be denied, have adopted a wise determination to concede to Honduras the Bay Islands, which would have been, no doubt, a perpetual bone of contention between this country and America, and would have been a standing theme for juvenile Casses and rising Cushings, to practise upon their nascent powers of oratory, like the case of "Peebles and Plainstanes" in the outer court. That arrangement is still more satisfactory on account of the security which has been taken, that the constitutional privileges conferred upon the inhabitants of Ruatan shall be continued to them, and that the ports of that island shall be free. By the charter conceded by the government of Honduras to the railway company, to be formed under the auspices of Mr. Squier and his associates, very valuable privileges are granted. It gives the company all lands and natural materials necessary for the purpose,—it provides that the company shall have a free passage over all lands, public or *private*, and it gives them a space of 200 yards on each side of the line of the road. Native labourers employed on the road are to be exempt from civil or military service, and goods and merchandise *in transitu*, are to pass free of charges on the part of the state, with the exception of a nominal sum for registry, to be paid by the company; and baggage of passengers is to pass without examination, or charge of any kind. The charter grants to the company 640,000 acres of land, and gives to them the exclusive right to purchase and locate on the line of the road or *elsewhere*, an additional 800,000 acres, at 12½ cents. (that is 6½d.) the acre, *payable in the stock of the company at par*. All persons settling on the lands of the company are to be entitled to all the rights and privileges of native-born citizens of the state, *and to be exempt for ten years from all kinds of taxes*, and all civil or military service, except with their own consent.

Furthermore the government agrees to give a bounty of fifty acres of land to each unmarried, and of seventy-five acres to each married labourer, who shall come to Honduras to work on the road, and who shall declare his intention of becoming a citizen. These concessions, conceived in a liberal and enlightened spirit, and evincing a sincere desire of improvement and of keeping pace with the progress of civilized nations, are doubtless of great importance, and will, when made generally known, it is to be hoped, have the effect of attracting European labour and enterprise to the theatre of operations.

The proposed railway is to commence on the Atlantic side, at Puerto Caballos, which is about six miles from the town of Omoa, and terminate at La Union, in the Bay of Fonseca, on the Pacific side. It will be 161 miles in length. After having crossed the rivers Chamelicon and Santiago, it will run parallel with the river Humuya for about 100 miles, and will then pursue the course of the river Goascoran to the bay of Fonseca, into which that river flows. Mr. Squier, in his published report upon this route, informs us that the rivers Humuya and Gascoran, and the plain of Comayagua, constitute a valley from sea to sea almost in a straight line, consequently no excavations will be necessary. From Puerto Caballos there is an inclined plane of 100 miles in length, the summit of which, at Rancho Chiquiti, near the source of the Humuya, is 2,400 feet from the level of the sea. This elevation not being sudden and precipitous, but being, as it is stated to be, a gradual ascent for 100 miles, is no great impediment. The road in its course will pass over a number of smaller streams, which will render necessary the construction of between 30 and 40 bridges. It will take in its way Comayagua, the capital, as well as several minor towns and villages. Santiago, containing a population of 400; Ojos de Agua, 350; Comayagua, the capital, 8,000; San Antonio Villa, 2,500; Lamani, 800; Aguanaterrique, 600; Caridad, 1,000; Saco, 600; and Goascoran, 1,200. It is stated that there is a sufficient depth of water, both in the bay of Caballos and in that of Fonseca, for vessels of a very large burden. This circumstance alone would render the Honduras route preferable to that of Panama as a traffic line. It is an undeniable fact that, in the bay of Panama, vessels of a large size cannot come within several miles of the shore.

The total cost of the Honduras railroad is estimated at 6,436,495 dols. The capital of the company will be 10,000,000 dols., or £2,000,000. The price of the shares 100 dols., or £20 each. The directors will be American and English gentlemen of the highest respectability. Amongst the English directors there will be, I have been informed, the following gentlemen:—William Brown, Esq., of Liverpool, M.P., Chairman; J. L. Ricardo, Esq., M.P., J. C. Ewart, Esq., M.P., Abraham Darby, Esq., W. Dent, Esq., Col. Tremenheere, and Charles Holland, Esq. With respect to these names no observation is requisite.

I have heard the feasibility of the inter-oceanic railway through the State of Honduras broadly denied. I have heard it asserted by gentlemen who have travelled in that country that insuperable difficulties exist in opposition to such a scheme. "Insuperable difficulties" is a strong phrase in these days, and ought not to be inconsiderately employed. Murphy, the translator of Tacitus, declared that a man, whose biography he wrote, was insane, because he projected a vessel which would go without wind; and it is not very many years ago when a distinguished scientific gentleman gave the world distinctly to understand that steam navigation across the Atlantic was an impossibility. In fact, there are few difficulties which energy, determination, science, and money are not able to overcome. Undoubtedly there might be some projects against the accomplishment of which nature would *appear* to oppose insurmountable obstacles. If any man were seriously to propose a mode of journeying to the moon, we might, perhaps, think a quiet corner in that planet the best place for him; or, if a modern Dædalus were to profess to teach the citizens of London the art of flying, which should entirely supersede the use of omnibuses, we should probably think less of clipping his wings than of shaving his head.

But what are these difficulties which will render the Honduras inter-oceanic railway impracticable? First, it is asserted that an unbroken chain of lofty mountains, over which it would be impossible to construct a railway, runs across the whole of the State of Honduras. If this were so there can be no doubt that the practicability of the scheme would be at least questionable. But have the gentlemen who make this statement had an opportunity of forming a correct opinion upon the subject? Or do they arrive at a conclusion with respect to what they have *not* seen, from that which they *have* seen? I very much suspect that the latter is the case. The persons to whom I have alluded, I have little doubt, give utterance to what they believe to be the fact, but all the knowledge which they possess of the country has been obtained during their various journeys to and from the city of Comayagua, performed upon the backs of mules. Now it is a well-known fact that the roads in Central America, which are mere bridle-paths, instead of winding round the base of the hills, which they might often do, take a direct course over the summits of the mountains. I have myself seen three or four hundred mules, laden with merchandise, proceed from Omoa towards Comayagua, like a troop of marching ants, in a direct line up the side of the mountain, when an additional mile or two would have given them a comparatively level road round the base. At Truxillo I have also seen fifty or sixty mules, laden with silver, come over the summits of the hills from the mines in the interior. The road from Ysabal to Guatimala, is the same. It is ascent and descent all the way. What opinion, then, of the general features of the country can those gentlemen form, who have only travelled over these mountain heights? Mr. Squier was nearly twelve months in Honduras, in company with competent surveyors, not merely passing through, not residing in one spot, but going from place to place, and accurately observing the whole surface of the ground. Besides, those persons who constitute the legislature and the government of Honduras must be supposed to know the features of their own country, and if a range of impassable mountains stretches across the whole of that state, it will scarcely be believed that they are unacquainted with the fact. But if such be the case, their conduct is strangely inconsistent with such a knowledge. They grant a charter to the company, they invite immigrants, and encourage them to become citizens of the state, by offering those who are married 75 acres of land, and those who are unmarried 50 acres; and they enter into a treaty, through their accredited agents, with Great Britain, with France, and with the United States, in reference to this very railway, which railway, if the aforesaid impassable range of mountains exist, can never be carried into effect. If the railroad be impracticable, all these treaties, conventions, charters, and solemn forms, are much more ridiculous than was the mountain, when, after much trembling and heaving, it produced its little whiskered offspring.

Another difficulty,—which really exists,—has been mentioned. But it is not one which bids defiance to skill and labour. It is said that during the heavy floods, in the rainy season, all the rivers, and even the smaller streams, are immensely swollen by mountain tributaries, and from sluggish waters, the current of which is hardly perceptible, and from trickling rills they become impetuous torrents, sweeping away everything in their course. This is certainly true. The rainy season in British Honduras,—and I suppose it must be pretty much the same in the state of Honduras,—commences in the month of June and ends about March. From March until the end of May, it seldom rains at all. From June until the month of November, the rain comes from the east, accompanied by strong breezes, and, at the commencement, with incessant thunder and lightning. From November until the latter end of February, the north winds generally prevail, and they frequently bring with them heavy rains, which continue for three or four days, and sometimes for a week at a time. But it must not be supposed that beause the season is called rainy, that there is nothing but rain whilst it lasts. Such is not the fact. At that period of the year, the weather is merely uncertain. There are often long intervals of a month's, or two months' continuance of fine dry weather. During the floods, the rivers, especially towards the source, rise to a great height. I have known them rise 30, 40, and even 50 feet in the coure of 24 hours. The current is then exceedingly rapid and powerful. In constructing the railroad, these circumstances must be borne in mind, and provided against. I do not apprehend that there will be any serious difficulty in doing this, for where the greatest rise takes place, the banks are the highest.

Most of the materials necessary for the undertaking (iron of course excepted) exist in abundance on the spot, or very near to it. Mr. Squier mentions mahogany, lignum vitæ, and oak for cross ties, &c. With respect to the two latter woods I can say nothing,—but he must not calculate upon mahogany; in the first place there is not a sufficient quantity of it; 2ndly, it would be too expensive if there were, (for it must not be forgotten that almost all the mahogany works in Honduras belong to English houses, and the wood would, therefore, not be obtainable without purchase); and 3rdly, it would be the very worst wood for the purpose. No wood is more perishable, when exposed to the action of water, than mahogany. In a very short time it becomes worm-eaten, and presents the appearance of a honey-comb. A great number of coasting schooners and droghers are built of mahogany, but if they were not well coppered, they would very soon be destroyed. It is, however, a very durable wood as long as it is kept dry. The best woods for railway sleepers, &c., of which there is a profusion in British Honduras, and probably in most of the lowlands in Central America, are the red pine and the sappodilla. The pine of Honduras contains more resinous material than the pine of any other country. The worms never attack it, and water only hardens it. The sappodilla is a hard, red, heavy wood, and will last for many years. Building stone, limestone, and an excellent clay for bricks can be procured in any quantity. In Omoa there is a large, strong, Spanish fortress, built of the stone of the country, and in Truxillo there is a similar structure. In the latter town there are the remains of what was once a magnificent episcopal palace, built of brick made of clay found in the neighbourhood. There is also a road which extends for a considerable distance into the country, built with bricks, which no doubt were manufactured on the spot. It would be well for the engineers employed on this railroad to give to the subject of brick-making some attention. The bridges, station-houses and other works, might be constructed, in a great measure, of bricks made of the clay of the country. With respect to fuel,—no doubt there is plenty of wood,—but whether or not there is coal, remains to be seen. Upon that subject I shall probably have to address you at no distant period.

The question of labour will demand very serious consideration. M. Alvarado, in a letter addressed to Mr. Squier, dated January 15, 1856, says, "The north coast of Honduras, as you well know, as also the departments bordering on it, have considerable towns peopled by a vigorous race of men, who are thoroughly acclimated, active, and inured to labour, known as Caribs. The almost exclusive occupation of these men is the cutting of mahogany. They are dexterous in the use of the axe, and well instructed in the management of oxen, and in the construction of common roads and bridges. Accustomed to work in the cuttings, under the direction generally of English, or American *empresários*, they have acquired a fair knowledge of the English language, and have been taught to work with method and regularity. It may also be observed of them that they are of good disposition and docile. This class of workmen may be had, on the section of the proposed road, from Puerto Caballos, to the mouth of the Rio Santiago, in number if needed, of from 2,000 to 2,500."

I am sorry to say that I am not able to concur with M. Alvarado in this statement. I have not the least doubt that he believes what he says, but I fear he is labouring under an erroneous impression. There is not the slightest dependence to be placed upon the Carib. He is idle and sullen, and quite incapable of continuous labour. Very few Caribs are employed in the mahogany works, the negro and the Mosquito man being greatly preferred. But, they themselves are indisposed to engage in any occupation which involves the necessity of hard work. Sometimes they are hired as domestic servants, but they never remain long in one place. The love of change is with them a passion. If you happen, to have a Carib servant, he will come to you unexpectedly some fine morning, and say, "Me going to take a walk massa." "Indeed, where are you going?" "Me going to my maamy. Me tired of work. Me go take rest. Me come back byamby." The Caribs have got settlements of their own, where they live by themselves. At a place called Stan Creek, about 20 miles from Belize, there are two Carib towns, one containing about 1,500 inhabitants, and the other 1,000. There is also one near Truxillo, containing about 3,000. These people occupy themselves chiefly in canoe-making and fishing. On the subject of labour, Mr. Follin also addresses Mr. Squier in the following terms:—"It is much to be regretted that we are not ready to begin work at once. Mahogany cutting is nearly abandoned, and 3,000 of the best men in the world for the enterprise can now be engaged at very *low wages*, from 12 dollars to 15 dollars per month, including rations."

To say nothing about the low wages of 15 dollars per month, including rations, which would be 8 dollars more, the statement that mahogany cutting is nearly abandoned, is far from the fact. There is not the slightest symptom of the abandonment of mahogany-cutting, nor could M. Follin, at any period of time, have engaged "3,000 of the best men" for the Honduras railroad. All the houses engaged in the mahogany trade to any extent are English, and the labourers employed in that business (who are principally negroes) are invariably hired in Belize. So far from 3,000 labourers having ever been thrown adrift, there has always been, and is now, a complete scramble to secure them. The proprietors of the railway must, therefore, dismiss from their minds all expectation of obtaining negro labour. Indian labour is equally hopeless. The Indians have only been accustomed to agricultural work. They are short in stature, small-limbed, weak, and altogether incapable of the violent physical exertion necessary in railway operations. I know only one class of persons in that country from whom railway labour might be obtained. I mean the Mosquito men, or, as they are more correctly called, *Weikas*. From amongst that people tolerably good navvies could be procured. But they are intensely indolent, and supremely brutal. Of all the human races which inhabit that portion of America, they occupy the very lowest grade on the ladder of civilization—they have not ascended one step. Were it not that they have the power of speech, doubts might exist as to what species they belonged, or credit might be given to Lord Monboddo's theory; however, they *have* a language, such as it is. They are capable of considerable physical exertion, and if a watchful overseer were placed over every fifty or sixty, they might be induced to get through a respectable amount of work. I do not mean (God forbid that I should) that they should be stimulated by the lash. But the Weika is not insensible to kindness; and words of encouragement, with promises of reward, would have more effect with him than blows. But why not take out European labourers? It is an error to suppose that Europeans cannot labour out of doors in a tropical climate. It is true that he cannot bear exposure to the scorching rays of the meridian sun, like the negro, the Indian, or the Weika, but he is able to do much more than all these put together, without injury to his health, if he only times his work. From six o'clock in the morning until ten, and from three o'clock in the afternoon until seven, any European might work with impunity. What is the reason, then, that so many Europeans die? *Because they drink.* Why not, then, drum for recruits in Ireland? Why not blow the horn in Belgium? Seventy-five acres of rich land (with, *perhaps*, a silver mine) to every married, and fifty acres to every unmarried labourer—the bounty which the Honduras government offers, "besides the ating and the dhrinking," would be no slight inducement to Pat.

There is good reason to believe that the Honduras inter-oceanic railroad would be preferred to that of Panama, especially for the conveyance of goods. At the present moment the greater part of general merchandise from Europe is conveyed to Lima, to San Francisco, to Guatimala, to Valparaiso, and other places in the Pacific round Cape Horn. A considerable quantity of cochineal is conveyed from Guatimala on the backs of mules over the mountains to Ysabal. Thence it is sent to Belize, in small coasters, and at Belize it is shipped for England. It is certain that the secure transit, by means of the Honduras railway from Fonseca to Caballos, and *vice versa*, would supersede the perilous journey along the giddy heights of Guatimala, and the long and tedious route by Cape Horn. The settlement of British Honduras could not fail to be greatly benefitted by this railroad. Instead of a small steamer, as at present, going from Kingston to Belize once a month, with the Honduras mails and one or two passengers, the large steamers that now go to Navy Bay, would most probably every fortnight go to Jamaica, from that island to Belize, with all the Pacific passengers on board (many of whom would land to procure fresh supplies), and having delivered the mails, would proceed to Caballos, land their passengers and cargo there, take in fresh goods and specie and passengers for Europe, and return again to Belize on their homeward voyage. All this would necessarily be of great advantage to British Honduras. A fresh impulse would be given to trade, new articles of commerce would be developed; energy and enterprise would be awakened; immigration would commence; and competition would ensue. The natural resources of Honduras are immense, and although the present inhabitants of that region are too blind to perceive them, too apathetic to regard them, or too indolent to utilise them, a new and more earnest people, not prostrated by tropical heats to a state of lethargic inactivity, not lulled to a dreamy repose by the rustling of the sea breeze through the broad leaves of the plantain, or the spreading branches of the shady tamarind, but strong in purpose, vigorous in action, determined in pursuit, would soon discover and avail themselves of riches, which have so long been left ungathered and despised.

I am, &c.,

R. TEMPLE.

25, Bernard-street, Russell-square, Sept. 8, 1856.

Home Correspondence.

THE PURIFYING OF WATER.

Sir,—In reply to the inquiry made by your correspondent, Leonard Rowe Valpy, I would suggest that the cheapest mode of filtering ponds of impure water would be to cause the noxious water to pass through the bank of the pond to a lower level, in the form of a spring or smaller pond. This is extensively practised in the East; and we are told in Baber's "Commentaries" that, by digging in the bed of any nearly stagnant river, we may obtain pure water, and we are informed that when the troops of Cæsar had the cisterns of Alexandria made impure by the enemy, the garrison got drinking water by sinking pits (*Alexandriæ Bellum, Auctore Hirtio*).

Yours, &c.,

GEORGE TWEMLOW,
Colonel Bengal Artillery.

Clapham Common, 7th Sept., 1856.

Proceedings of Institutions.

Burton-on-Trent.—The general meeting of subscribers to the Literary Society was held on the 20th August, when the following report was presented:—"Your Committee have again the satisfaction of being able to report favourably of the progress of the Society. Previously to the last year it had always been found necessary to appropriate part of the following year's subscriptions for the purpose of meeting the current year's expenses, and in some years this was done to a considerable extent.—The balance, however, against the Society had for the last few years been gradually reduced till on the 30th June, 1855, it amounted only to £5 0s. 1d. The Committee have the pleasure to announce that, after making very large additions to the library, and with an increased outlay upon the News Room, at the close of the year ending the 30th June last, there remained a balance in hand of £11 11s. A balance-sheet of the income and expenditure for the past year is appended to the report, and the prosperous condition of the Society which it discloses, cannot fail to be highly satisfactory to the subscribers. The library now consists of nearly 2,000 volumes, no less than 307 having been added in the course of the year. A considerable number of fresh periodicals and magazines have been taken from the Reading-room, and it is confidently hoped that, now the Society is freed from debt, an equal or larger addition may be made annually. The Committee would, however, urge upon the subscribers the importance of individually endeavouring to increase the prosperity and efficiency of the Society, by inducing others to become members of it, as the Committee cannot but remark that the list of subscribers, in proportion to the numbers of the classes in this town for whose benefit it was instituted, is very small. Arrangements will be immediately entered into for securing a regular course of lectures, during the ensuing winter, from some of the most popular lecturers of the day. The Society having joined the Union of Institutions in connexion with the Society of Arts, its members will have the privilege of being admitted to any of the Institutions forming the Union, on producing their tickets of membership with this Society. Such tickets will be immediately issued. To those members whose occupations take them frequently from home, this will be found a great advantage, as Institutions in most of the principal towns in the kingdom belong to the Union."

MANCHESTER.—The Art and Industrial Exhibition with which it was intended to inaugurate the new Mechanics' Institution at Manchester was opened on Tuesday last. Although Lord Palmerston was prevented by a family bereavement from fulfilling his engagement by presiding on this occasion, it was exceedingly well attended by season-ticket holders of a guinea each, and it speaks well for the success of the Exhibition that among the first attendants were many of the leading and most wealthy inhabitants of the town and neighbourhood. There were Mr. Oliver Heywood, president of the Institution, the Lord Bishop of Manchester, Mr. W. Brown, M.P., Mr. Bazley, president of the Chamber of Commerce, Mr. W. Fairbairn, C.E., F.R.S., Rev. Dr. Booth, F.R.S., and others, who have taken a warm interest in the Institution for years past. The principal portion of the company having assembled in the lecture-hall, after the National Anthem had been given by a full choir, accompanied by the organ, **MR. OLIVER HEYWOOD**, the president, briefly opened the Exhibition in a short address, in which he said, it was the wish of the directors with whom he had been associated in the erection of that building that he should express the gratification and encouragement they derived from the presence of so many friends. They had hoped that their first assembling within those walls would have been under very different circumstances, and it was their wish to connect the opening of the exhibition with the inauguration of the new building, and to avail themselves of the opportunity which the occasion appeared so happily to afford of giving a new impulse to the work in which they were engaged. They thought that the past history of that Institution, which was among the earliest of its class, and which had contributed so largely to the intellectual, social, and moral improvement of the community, might be traced with interest and advantage from its day of small things, during a long and successful career, until when self-supporting, free from debt, with 1,600 members, of whom 700 were in regular attendance at its day and evening classes, and with a library of 1,300 volumes, the building which it occupied for a quarter of a century (let it be remembered for the credit of Manchester that it was the first erected in this country for such a purpose), was found inadequate to meet the demands of a growing community, and an appeal was made for assistance to enable them to provide accommodation for those to whom, from lack of space, they were under the necessity of refusing admittance into the classes. With what success they would perceive. But, however gratifying and instructive the retrospect might be, the conviction that the future welfare of the Institution must depend upon the intelligence and wisdom with which it was conducted, made them especially anxious that at their day of opening they should be surrounded by some of the most distinguished friends of popular education, that expression might be given to the most enlightened views on this subject which experience had taught, that their future course might be marked out, and their energies quickened to pursue it; and they ventured to hope that the labours of the season being over, peace secured, and attention again turned to the development of commerce and the improvement of the people, the noble lord who, after so long a life devoted to the public service now directed the councils of the nation (Lord Palmerston), would not withhold his consent to be present on the occasion, and to visit a community which by its industry contributed so largely to the national wealth, and of which he might say with truth that it was in advance of every other in this kingdom in its provision for the social gratification and physical well-being of its industrious classes, as well as for the persevering efforts which it had made to secure for them, and at its own cost, the advantages of a sound education. The kindness with which the noble lord received and assented to their request would not soon be forgotten, and if he (the President) forbore now to make more than a passing allusion to the deep regret with which they lamented the noble lord's absence, it was because he felt that the domestic bereavement which was its cause forbade them to dwell upon their own disappointment. They hoped, however, that the visit was only postponed, and that hereafter, under happier circumstances, and at no very distant day, the Institution might have the gratification of welcoming him within its walls. The Exhibition they opened to day was the fifth which had been undertaken and successfully carried out by the directors of the Institution. Their fame had long gone by, eclipsed by the grander conceptions of later times, yet Manchester might recollect with pride that she was the first to set the example of these industrial exhibitions, and that the announcement which the directors were able to make at the conclusion of the first — now 20 years ago — that, after having been visited by upwards of 60,000 people, it had closed without wilful injury to any single article exhibited—led to the opening of the Museum and other Institutions in Manchester, and was the circumstance upon which Mr. Hume, in the House of Commons, founded his motion for the opening of the British Museum. It was no prominent part of their scheme to provide mere amusement; but they did not think it inconsistent with the higher objects to which they proposed hereafter to devote themselves to endeavour, by exhibitions such as this, to awaken new and nobler tastes, to excite curiosity and inquiry, to emancipate the heart from false pleasures, that it might be open to the reception of new—in short, to give a desire for knowledge by presenting it in an attractive form. After expressing a wish that this exhibition, though on a humbler scale, might supply a want to the working classes which they could not attain through the greater and nobler efforts at London, Paris, and Dublin, the President concluded by announcing that the Exhibition was open, and the company were at liberty to pass at pleasure through its various departments. The opening ceremony concluded with a concert.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette September* 5*th*, 1856.]

Dated 15*th August*, 1856.

1907. John Burns Smith, Manchester—Certain improvements in machinery for preparing, spinning, and twisting cotton and other fibrous substances.
1909. Henry Alfred Jowett, Sawley, Derbyshire—Improvements in rails and railway chairs, and in the construction of railways.
1911. Charles Richard Skinner, St. John's, Worcester—Certain improvements in tanning and finishing off leather.

Dated 16*th August*, 1856.

1913. William Tranter, Birmingham—Improvements in fire-arms.
1915. George Slater, John Williams, and Septimus Whitaker, Burnley, Lancashire—Certain improvements in power looms for weaving.
1917. John Weir Draper Brown, Burrel's Hotel, London-bridge, and George Gibson Brown, Deptford Dockyard—Improvements in signal lanterns.
1919. Samuel Lilley, Birmingham—Improvements in the manufacture of ships' iron work, a part of which improvements is applicable to the manufacture of other articles in iron.
1921. Louis Auguste Joyeux, Marseilles—Improvements in obtaining motive power.

Dated 18*th August*, 1856.

1923. Thomas Scott, Barnhill Workhouse, Glasgow—Improvements in cooking.
1925. William Edward Newton, 66, Chancery-lane—Improved machinery for cutting and finishing metal screws. (A communication.)
1927. William Edward Newton, 66, Chancery-lane—Improved machinery for forging or working iron and other metals. (A communication.)
1929. Richard Archibald Brooman, 166, Fleet-street—Improvements in stopping or retarding railway carriages and trains, and in preventing carriages running off the rails. (A communication.)
1931. Charles Marie Chouillon, Paris—Certain improvements in thinning or shaving tawed, tanned, or dressed skins.

Dated 19*th August*, 1856.

1933. Henry Forfar Osman, 33, Essex-street, Strand—An improved electric clock. (A communication.)
1935. Edwin Sutton, 204, Regent-street—An improved construction of stereoscope.
1937. Robert Jobson, Wordsley—Improvements in apparatus for pouring iron or other metal into moulds.
1939. Joseph Brouard and Joseph Hubert, 39, Rue de l'Echiquier, Paris—Certain improvements in reefing the sails of ships or vessels.
1941. William Edward Newton, 66, Chancery-lane—An improvement in valves for steam engines. (A communication.)

Dated 20*th August*, 1856.

1943. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in steam engines. (A communication.)
1945. Thomas Sagar and Christopher Turner, Burnley, Lancashire—Certain improvements in power-looms for weaving.
1947. William Gossage, Widnes, Lancashire—Improvements in obtaining sulphur and metals from certain ores and other compounds of metals.
1949. William Stones, Greenhithe, Kent—Improved machinery for damping sheets of paper intended to be printed upon, so as to render the usual operation of wetting unnecessary.

Dated 21*st August*, 1856.

1952. Joseph Crossley and James Bolton, Halifax—Improvements in apparatus or means employed in the printing of yarns for carpets and other fabrics.
1956. Robert Kenton, Birmingham—A new or improved manufacture of fishing reels.
1958. George James Farmer, Birmingham—Improvements in machinery to be used in the manufacture of chain links, buckles, buckle slides, rings, and other similar articles.

Dated 22*nd August*, 1856.

1960. William Patten, 22, Old Fish-street, Doctors'-commons—An improvement in apparatus for supplying water to the basins of water-closets and other vessels.
1962. William Edward Newton, 66, Chancery-lane—Improved machinery for cutting chenille. (A communication.)

Dated 23*rd August*, 1856.

1964. Frederick Albert Gatty, Accrington, Lancashire—Certain improvements in dying.
1966. Edward Hallen, Cornwall-road, Lambeth—Improved means for washing wool.
1968. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in casting metals. (A communication.)
1970. Etienne Sterlingue, Paris—Improvements in preparing for tanning, and in tanning hides and skins.
1972. George James Farmer, Birmingham—Improvements in hardening iron and steel.
1974. Samuel Stocks, Collins Green, near Warrington—Improvements in reaping machines.

Dated 25*th August*, 1856.

1946. Charles Clark, Somerset-terrace, Albion-road, Stoke Newington—Improvements in combining and arranging looking glasses for toilet purposes.
1948. Jules Laleman, Lille, France—Improved machinery for combing flax and other fibrous materials. (A communication.)
1950. Joseph Maudslay, Lambeth—Improvements in steam engines, especially applicable to screw propulsion.
1976. Marc Antoine François Mennons, 21, Rue Napoléon Montmartre—A new composition applicable to the coating or covering of metallic and non-metallic surfaces. (A communication.)
1978. Pierre Philippe Celestin Barrat and Jean Baptiste Barrat, Paris—Improvements in steam-digging apparatus, suitable for draining and excavating purposes, parts of which are applicable to reaping.
1980. William Frederick Plummer, St. Mary's Overy Wharf, Southwark—Improved apparatus applicable to the grinding of grain and other substances.

Dated 26*th August*, 1856.

1984. William Henry Perkin, King David Fort, Middlesex—Producing a new colouring matter for dyeing with a lilac or purple colour, stuffs of silk, cotton, wool, or other materials.
1986. Joshua and Thomas Horton, Birmingham—An improvement or improvements in the manufacture of paper, pasteboard, and pulp.
1938. Edward Alfred Cowper, Great George-street, Westminster—An improvement in the manufacture of candles.
1990. Edmund Simpson, Preston, Lancashire—An improved safety cage for mines and pits, or apparatus to be fitted to cages to prevent accidents from the falling thereof.

Dated 27*th August*, 1856.

1994. Louis Horrie, Keighley, Yorkshire, and James Schofield, Rochdale, Lancashire—Improvements in the mode or method of extracting oil and grease separately from suds used in washing flannel and other woollen goods, for distilling the said grease or other fatty matters, and in the apparatus employed therein.
1996. John and William Moore, Aston, near Birmingham—A new or improved tap or stop-cock.
1998. Samuel Roberts, Hull—Improvements in regulating the supply of steam to engines working screw or submerged propellers, and in regulating or relieving the pressure of steam on slide valves.
2000. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for combing fibrous substances. (A communication.)
2002. William Green, George Holloway, and Thomas Grubb, Kidderminster—Improvements in the manufacture of rugs.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2011. Edward Poitiers, 12, Malden-terrace, Haverstock-hill—The application of a new material or materials for the manufacture of brooms and brushes in general and for other purposes, and for improvements in the manufacture of street scavengers' and other brooms and brushes.—29th August, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed September 5*th*, 1856.

565. Robert Morrison.
574. Thomas Cook.
575. Henry B. Young.
576. Henry Cooke.
587. Alexandre Tolhausen.
590. Oliver Maggs.
603. John Northcote Ryder.
610. Isaac Dixon.
635. Charles Benjamin Normand.
653. Augustus Dacre Lacy.
681. John Hinks and George Wells.
697. William Pitt and Edwin Turner Davies.
717. Alexandre Tolhausen.
718. Alexandre Tolhausen.
725. James Rock, jun.
730. Alexandre Tolhausen.
741. Joseph Auguste Barratte.
762. Charles Benjamin Normand.
767. Charles Durand Gardissal.
996. William Gossage.
1013. John Hick.
1027. William Edward Newton.
1239. Thomas Herbert and Edward Whitaker.
1348. William Watson Hewitson and William Hamond Bartholomew.
1419. William Henry Barlow and William Henry Woodhouse.
1583. Lorenzo Blackstone.
1587. Alfred Louis Stanislas Chenot and Eugène Charles Adrien Chenot.
1588. Alfred Louis Stanislas Chenot and Eugène Charles Adrien Chenot.
1589. Alfred Louis Stanislas Chenot and Eugène Charles Adrien Chenot.
1590. Alfred Louis Stanislas Chenot and Eugène Charles Adrien Chenot.
1595. William Laing.

Sealed September 9*th*, 1856.

581. Pierre Denis Nelot.
586. Joseph Davy and John Milnes.
608. Joseph Sturge and Alfred Sturge.
609. George Rees.
652. Thomas Richardson and George William Jaffreys.
692. James Robertson.
759. Alfred Trueman.
788. William Roberts.
1040. Richard Pearcy.
1188. George Wilkinson.
1439. Charles Edmond Green.
1490. Henrich Ludwig Buff and Frederic Versmann.
1504. David White.
1568. Hilton Greaves.
1618. Rudolph Bodmer.
1688. Francis Barber Howell.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

September 1*st*.

2119. James Hill Dickson.
2171. Charles Collins.

September 3*rd*.

2046. William Edward Newton.
2052. James Davis and Robert Ramsay.
2092. John Grist.

September 4*th*.

2042. John Clare.
2097. Robert Tronson.

September 5*th*.

2076. Michael Leopold Parnell.
2326. William Beardmore and William Rigby.

September 6*th*.

2058. David Law and John Inglis.
2065. Robert Harrington.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 19, 1856.

REGISTRY OF CANDIDATES WHO HAVE OBTAINED CERTIFICATES.

The Council of the Society of Arts have resolved to open a Public Registry for the benefit of employers and the young men who pass with credit the Society's Annual Examinations. The following circular has been issued by the Secretary:—

"Society of Arts, Manufactures, and Commerce,"
Adelphi, London, Sept. 1, 1856.

Sir,—I am instucted to bring under your notice the subjoined recommendation of the Board of Examiners appointed to conduct the Society's Examinations, and confirmed at a recent meeting of the Council of this Society.

"The Board of Examiners are entirely of opinion that a great additional value would be imparted to the Certificates issued by the Society of Arts, and to the prizes awarded, were the Council to open a Public Registry of all those persons who from time to time shall obtain the Society's Certificates, and shall be desirous to procure employment. Through such a Registry the Council would be enabled to afford to employers precise and accurate information—the result of a prolonged and searching inquiry—as to the attainments and intellectual ability of any of their certificated candidates."

The importance of a Registry of this kind, if freely used by the public, can scarcely be overrated. To employers, who may wish to secure the services of intelligent and industrious young men, it will afford a precise and in most cases an unerring* test of the actual attainments and ability of those persons whose names appear on the register. They must all possess a certain amount of industry, intelligence, and acquirement; for no one will be permitted to place his name on the register who shall not have obtained at least one Certificate at the Society's Examinations. The Registry will be so arranged as to give the name, age, place of residence, previous occupation, employer if any, and the subjects in which Certificates have been granted. Employers who take an interest in the progress of National Education, and who desire to encourage habits of self-instruction and of steady application in the young men of England, are invited to avail themselves of the facilities which will be afforded them, free of charge, by the Society of Arts' Registry. Every appointment thus filled will not only have rewarded some industrious and deserving young person, but will stimulate many others to enter on and persevere in a course of patient labour for their self-improvemeut.

Although employers must satisfy themselves of the moral qualities of their candidates, and the Council do not profess to give any guarantee on this head, yet they are of opinion that a young man who must necessarily have devoted to study a large portion of the time at his disposal, often very scant, can scarcely have had much leisure for idle pursuits or vicious indulgences.

I beg to call your attention to the subjoined "Declaration," which has received upwards of five hundred signatures, including those of Manufacturers, Merchants, Bankers, Ironmasters, Shipbuilders, Railway Companies, Insurance Companies, and various other firms, &c.; as also to furnish you with a list* of those persons who obtained Certificates at the Society's Examinations held on the 10th, 11th, 12th, and 13th, of June last, at the Society's house in the Adelphi, with the subjects in which Certifiates and prizes were awarded to them. The Council desire the expression of your approval to a plan, which, if generally supported, may become a great national benefit.

I have the honour to be your very obedient servant,
P. LE NEVE FOSTER,
Secretary.

DECLARATION.

"We, the undersigned, having considered the Memorandum of the Council of the Society of Arts, and the plan therein set forth, for examining and granting certificates to the students of classes for instruction in the Literary and Scientific Institutions, Mechanics' Institutes, Athenæums, and other similar bodies in union with the said Society, do hereby declare that we desire to promote the success of the said plan, and are prepared to regard as *testimonials worthy of credit* such Certificates as may be awarded in conformity thereto."

METHYLATED SPIRIT.

A Report has been addressed to the Commissioners of Inland Revenue, by Professors Graham, Hofmann, and Redwood, on the supply of Spirit of Wine, free from duty, for use in the arts and manufactures, without injury to the revenue. In order to carry out this object it was necessary that the spirit should be first rendered unfit for human consumption, and that after being thus treated it should still be so pure as to be generally available for use in the arts and manufactures, without being capable of being made palatable by any simple process of rectification or otherwise. It also seemed important that no poisonous properties should be communicated to it.

Experiments were made with various volatile substances, which seemed adapted for mixing with the alcohol in order to fulfil these conditions, but the greater number were found unsuitable upon a close consideration or actual trial of their properties. Among these may be mentioned sulphide of ethyl and various volatile oils and ethers, which are too easily separated by distillation. The liquid distilled from caoutchouc, and known as caoutchicene, seemed to obviate this objection to a great extent, but the intense and disagreeable odour communicated to the spirit would have considerably limited its applications. The report then proceeds in the following words to give an account of the substance which has been employed with success:—

"Our attention had been particularly directed to wood naphtha (crude pyroxylic or methylic spirit), as the substance to be added to alcohol, by the previous experiments of Mr. G. Phillips and of Dr. Hofmann on the use of that liquid. The application of crude wood-naphtha depends partly upon the empyreumatic oils which it contains, and partly upon the methylic spirit and other substances miscible with water, which constitute the mass of the liquid. It was necessary to examine separately the influence of these two classes of constituents, and first of the empyreumatic oils.

"In one series of experiments, a specimen of the oils which had been separated from wood-spirit in the process of purifying that liquid, was used as the flavouring substance. Two per cent. of these oils were dissolved in spirits of wine. This mixed spirit had the strong characteristic odour of crude wood-naphtha, became milky when mixed with water, and was highly unpalatable.

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* It has long been known that the system of granting appointments upon the faith of testimonials is a bad one. Carelessness—what is called good nature, but which would be more justly described as a want of principle—private interest—the desire to repay an obligation or get rid of a bore—these are the prolific parents of recommendations which ought never to have been given, but against which it is extremely difficult for the dispensers of patronage to guard themselves.—*Athenæum*, p. 1021, *Aug.* 16, 1856.

* For this list see No. 188 of the *Journal*.

"When this mixed spirit without any addition was simply distilled by the heat of a water-bath, a small quantity of a dark-brown tarry matter was left behind in the retort, and the proportion of oils in the distilled spirit was greatly reduced. This mixed spirit appeared to be further purified when distilled from anhydrous sulphate of copper, from the protosulphate of iron, or from persulphate of iron. But none of those distillates was potable, and all became turbid with water. The flavour of the same mixed spirit was improved by distillation with one-eighth of its weight of sulphuric acid, but the liquid was still not potable. When the last distillate was again rectified from one-twentieth of its weight in potash, the rank odour of the oils disappeared in a great measure, the odour now retained resembling that of benzole. An attempt was made to remove the odour last described, by diluting the liquid with water, and passing it in the state of vapour over animal charcoal, but the liquid still retained the benzole odour, and was precipitated by water.

"The greatest amount of purification was obtained by distillation from potash or lime, the alkali keeping back the creosote; but the mixed spirit still retained the tarry smell of benzole, and was turbid with water. When the mixed spirit, so far purified by means of alkali, was diluted with water and again distilled, the first half of the new distillate was turbid with water, and even formed a layer of oil on the surface. But the second half of the distillate did not become turbid with water, showing that the benzole product comes off first. This last portion of the alcohol appearing to be restored to a fair degree of purity, it became doubtful whether much dependence could be placed upon the oils of wood-naphtha, for the purpose of mixing, apart from the methylic spirit of the naphtha. An experiment was made with pure benzole itself, mixing the proportion of one part of benzole to ninety-nine parts of strong alcohol. A considerable portion of benzole was separated from this mixture by dilution with water, the benzole forming an oily film on the surface of the liquid. The liquid, however, continued milky, and retained a strong odour of benzole. When this mixed spirit was diluted with three times its volume of water, and slowly rectified, the first half of the distillate contained much benzole, and became milky with water, while the second half of the distillate did not become turbid with water, and appeared to contain very little benzole. This result affords a very strong presumption that benzole is removable by rectification from alcohol when diluted with water.

"Three additional and still more extensive series of experiments were made by means of different varieties of crude wood naphtha, as this substance varies considerably in composition. Two of the varieties were procured from Messrs. Turnbull and Co., of Glasgow, one of which was described as 'of full strength, but concentrated without destroying the oils;' the other described as taken 'at an earlier stage of the process, half strength, and containing more oils than the last.' The third material operated upon was a mixture of strong alcohol with five per cent. of crude naphtha, prepared at the laboratory of Inland Revenue by Mr. Phillips. But after what has been already said it is unnecessary to enter into the details of those experiments, as the results were similar to the first series. The oils were, in a great measure, removed from the mixed spirit by simple distillation, or by distillation from potash, and the distilled spirit was chiefly characterised by the taste and comparatively mild odour of methylic spirit or pure wood-spirit. The specimens became as little offensive as alcohol mixed with Turnbull's purified wood-naphtha; and there appeared, therefore, to be no great advantage in using the crude naphtha for mixing in reference to a purer wood-spirit. The question reduced itself to the applicability of pure wood-naphtha for the object in view.

"The wood-naphtha hereafter used for mixing with alcohol was of the comparatively pure quality in which it is supplied to the public by Messrs. Turnbull and Co., at the price of 8s. 6d. per gallon. This wood-naphtha was nearly colourless; it mixed with water without becoming turbid in the least degree, and contained no more than a small trace of the oils which gave a rank and repulsive odour to many species of wood-naphtha. The odour of this purified wood-naphtha was not disagreeable, although well marked and characteristic, being due principally to methylic spirit. The specific gravity of this naphtha was 0·815, and its boiling point 151° Fahr. When thoroughly dehydrated by being distilled three times from half its weight of anhydrous sulphate of copper, one gallon of the liquid gave by fractional distillation the following series of liquids, each amounting to about a pint:—

1st	distillate of	sp. gr.	0·8067;	boiling point	143.6°	F.
2nd	,,	,,	0·8047	,,	143·3°	,,
3rd	,,	,,	0·8031	,,	146·5°	,,
4th	,,	,,	0·8208	,,	146·5°	,,
5th	,,	,,	0·8016	,,	148°	,,
6th	,,	,,	0·8008	,,	150°	,,
7th	,,	,,	0·8009	,,	151°	,,
8th	,,	,,	0·8015	,,	151°	,,

Fractions 1 and 2 distilled again together from anhydrous sulphate of copper, retained the low boiling point 143·5°, and had the mean density 0·8057, which is a liquid possessing the lowest boiling point that has been assigned to methylic spirit, but with a somewhat higher specific gravity, the specific gravity of pure methylic spirit being about 0·800. None of the fractional portions appear to be a single substance. The methylic spirit is probably accompanied in the earlier fractions with acetone of sp. gr. 0·792 and boiling at 132·8°, and acetate of methyl of sp. gr. 0·908 and boiling at 144°; while some third liquid, of which the nature is unknown, must be present to impart the high boiling point combined with a low specific gravity which distinguishes the latter fractions of the distillate.

The presence of five per cent. of this purified wood-naphtha in strong alcohol is easily recognised by its taste and odour, and is more than sufficient to render spirit unsaleable as a beverage, as has been ascertained upon good authority. At the same time the odour of the mixed spirit on evaporating in the air is by no means offensive. In solvent power such a mixed spirit is indistinguishable from pure alcohol; and varnishes made by means of it dry readily and acquire no odour or peculiar character from the menstruum. Farther, no practicable means of separating the methylic spirit again and recovering the spirit of wine in a state of purity and suitable as a beverage, appear to exist; while the substance which destroys the potability of the mixed spirit, without impairing its value for many useful purposes, is not itself poisonous or unwholesome, wood-naphtha, as is well known, having been used to some extent in medicine. The purified wood-naphtha appears indeed to be singularly well adapted for the preparation of a mixed spirit such as the government desires to supply duty-free to manufacturers. At the same time a mixed spirit containing 10 per cent. of the purified wood-naphtha appears to be preferable to a five per cent. mixture, from the great facility of recognising the wood-naphtha in the larger proportion, particularly when disguised by the presence of other volatile and odorous substances. A ten per cent. mixture might therefore be issued in the first instance, and the proportion of wood-naphtha be reduced at a later period if it was found that the change could be made with safety to the revenue. It is accordingly a ten per cent. mixture which we have had tested for the various useful applications of alcohol, because if this mixture was found to meet the requirements of trade, the suitability for the same purposes of any mixture containing a less proportion of wood-naphtha might be safely assumed.

"Although wood-naphtha (methylic spirit) and alcohol are of unequal volatility, there being a difference of about thirty degrees between their boiling points, yet no sensible separation of these liquids can be effected by distillation. Both the 5 and 10 per cent. mixtures described were submitted to fractional distillation; but wood-naphtha was found in all the fractions. Even the last eighth portion of the 5 per cent. mixture, which was not distilled over, but was left behind in the retort, contained abundance of wood-naphtha, the more volatile constituent. In another experiment, to be described in the sequel, rectification repeated several times failed equally to eliminate the smallest portion of pure methylic spirit from the mixed spirit. The reason of this is, that alcohol which boils at the higher temperature has a denser vapour than methylic spirit, in the proportion of 1·600 to 1·125. The less volume of alcohol vapour which distils over at the boiling point of the mixed spirit is compensated for by the greater weight of that vapour, so that the proportion between the constituents of the mixed spirit appears to be little if at all disturbed during the progress of the distillation.

"The similarity in chemical constitution of methylic spirit and spirit of wine, both being alcohols, is attended with a remarkable analogy in properties between the two substances, which appears to render their separation by chemical means also a problem of great, if not insuperable, difficulty.

"Methylic spirit forms a solid crystalline compound with chloride of calcium,—a property which is taken advantage of in purifying methylic spirit, for scientific purposes, from the other liquids by which it is accompanied in wood-naphtha. Our mixed spirit being first carefully dehydrated by means of sulphate of copper, and reduced to a specific gravity of 0·801, was then mixed with chloride of calcium, in excess, so as to form a thin paste, and distilled by a water-bath heat. Methylic spirit was easily discernible by its odour in the distillate which came over; so that the presence of ordinary alcohol in a large relative proportion appears to prevent the combination of methylic alcohol with chloride of calcium, or to decompose such a compound when formed; for ordinary alcohol, as well as methylic alcohol, has a considerable affinity for the salt in question. When water was subsequently added to the chloride of calcium nearly dry in the retort, and the heat renewed, a liquid came over which possessed a peculiar and disagreeable odour, but appeared to be chiefly composed of ordinary alcohol. This liquid should have been methylic spirit if the experiment of separation had been successful.

"The attempt was also made to purify the alcohol of our mixed spirit from its accompanying methylic spirit, by passing the vapour of the two liquids through a long glass tube containing fragments of chloride of calcium, which was kept at a temperature of 212° during the experiment. No absorption, however, of the methylic spirit by the chloride of calcium occurred, but the salt remained unaltered, and the alcohol distilled over and condensed with its original proportion of methylic spirit.

"Several experiments were also made on the oxidation of the mixed spirit by means of various proportions of the mixture of bichromate of potash and sulphuric acid, with the view of oxidising and removing the methylic spirit, but without success. The oxidation products were acetic acid and formic acid, accompanied by much aldehyde, and indicated the decomposition of the alcohol as well as of the methylic spirit.

"Sulphuric acid is very useful for discovering the presence of common alcohol when mixed with wood-spirit from the ready production of ordinary sulphuric ether. But for the converse problem of separating a small proportion of wood-spirit from a large proportion of alcohol, sulphuric acid appeared to be wholly inapplicable.

"Oxalic acid employed to etherise the mixed spirit seemed at first to promise better results, as the methylic oxalic ether appeared to form more easily than the corresponding ethylic ether. After the cohobation of the dehydrated mixed spirit with oxalic acid for several hours, the liquid which came over on distilling was alcohol with the proportion of methylic spirit apparently considerably reduced. This alcohol always contained portions of the oxalic ethers, and was liable to become acid from the gradual decomposition of these ethers. The flavour of the methylic spirit, which is at first covered by a rum-like flavour of these ethers, would no doubt come out with time, and prove, as usual, highly disagreeable. No economical process for the purification of the mixed spirit could, we believe, be founded on the action of oxalic acid.

"The conclusion from much investigation is, that the removal of wood-naphtha from the 10 per cent. mixed spirit, and the restoration of its potability by any simple and economical process is a most unlikely occurrence. We apprehend no danger whatever to the revenue from this source. The mixture of spirits of wine with ten per cent. of purified wood-naphtha or methylic spirit, which we recommend, may be designated *methylated spirit*, for convenience.

"The quantity of wood-naphtha which can be commanded appears to be amply sufficient for the new contemplated application of that substance. We are indebted to Mr. John Turnbull for his valuable opinion on this point. 'My calculation regarding wood-spirit,' that gentleman states, 'is a produce of two gallons and a half from a ton of average dry wood, and the production of the United Kingdom amounts annually to 66,000 gallons. This I take as the proceeds of nineteen manufacturers of pyroligneous acid; although you must receive it as a rough guess, still I believe it is not very far from the truth.' Much wood-naphtha is also attracted to this country from the Continent, owing to the high price which that liquid obtains here as a substitute for alcohol.

"We have been favoured with the opinion of Mr. G. Smith, of Whitechapel, one of the most extensive London distillers, on the application of our methylated spirit as a beverage. He pronounces the methylated spirit to be quite unfit for the use of the rectifier. He believes that publicans would never use such a spirit for mixing with their liquors, even in a small proportion. A mixture of gin with one-eighth part of the methylated spirit was found to be nauseous and unpalatable. In gin mixed with one-sixteenth of methylated spirit, the flavour of the latter was still very strongly marked. In gin with one part of methylated spirit in thirty-two, the flavour of the methylated spirit became faint, but it was still perceptible in a mixture of one to sixty-four. The largest proportion of the methylated spirit which it was thought a publican might venture upon adding to his gin was one in thirty-two. Now, the saving to him would be the same fraction of the spirit duty, or proportion of 6s. 2d. per gallon, the duty on spirits of the strength of gin—that is, a profit of 2¼d. per gallon. So small a profit would be no compensation for the deterioration in the quality of the gin. The disagreeable odour of the methylic spirit is brought out strongly on mixing the gin with hot water.

"The consumption of sweetened and highly-flavoured cordials appears to be greatly inferior to that of gin; a publican in large business, who may retail 1,200 gallons of gin per month, not disposing of more than ten or twelve gallons of cordials in the same time. The substances chiefly used in flavouring cordials are carraways, cloves, and aniseed. The methylated spirit could not be used for any of these liquors. Indeed, from their being generally made use of to give an extempore flavour to gin at the option of the customer, more than usual attention must be paid to their own purity of flavour.

"The flavour of brandy is too delicate to be tampered with by the addition of the smallest proportion of methylated spirit. The addition of the latter substance to whiskey would require to be guarded against, from the predilection of the consumers of that spirit to a smoky flavour. An experiment has been related to us, in which methylic spirit was employed for the sake of its flavour by a Scotch distiller, and mixed with spirits in the minute proportion of one gallon to 1,000 gallons. The flavour, although not objected to in the whisky when newly mixed, became rank and disagreeable in the course of two months. The mixing of methylated spirit with that low quality of rum known as Leeward Islands rum, is also to be apprehended, from the great impurity of that spirit, which would render any additional contamination less obvious to the palate. But when the liquid is deliberately examined, the presence of methylic spirit could not escape detection.

(*To be continued.*)

THE MANUFACTURE OF IRON WITHOUT FUEL.

In the last number of the *Journal*, brief reference was made to certain patents bearing on Mr. Bessemer's invention, and the importance of the subject renders it desirable to give them at length as well as the substance of another patent granted to Reuben Plant. The date and title of Plant's patent are as follows:—

Letters patent to Reuben Plant, of Holly-hall Colliery, near Dudley, in the county of Worcester, coalmaster, for "Improvements in Making Bar or Wrought Iron." Patent dated July 18, 1849. The invention is for a puddling furnace of the ordinary dimensions; there should be three lines of tuyeres across the top of the furnace, each line consisting of three tuyeres, and each tuyere being one inch in diameter; the line furthest from the chimney should be the tuyeres for the blast, and the other two lines the steam tuyeres for the puddling and preparatory chambers. The blast is to be at a pressure of one pound and upwards to the square inch, and the steam is to be used at a pressure of ten pounds and upwards on the square inch. The blast should be introduced at the top of the puddling chamber, just behind the fire-bridge, in a slanting direction, so as to drive the flame, as it enters the puddling chamber, down upon the whole surface of the iron. The steam from the tuyeres should be introduced as nearly as possible at the same place, so as to fall in like manner at once upon the whole surface of the iron in the puddling chamber.

It is stated that by means of the above arrangements the heat of the puddling and preparatory chambers can be regulated with great nicety without the employment of the damper usually inserted in the chimney of a puddling furnace. When the metal in the puddling chamber is melted, the blast is to be shut off, and steam introduced through the tuyeres until the iron boils. The steam is then to be turned off, and the blast is again brought into action till the iron appears above the cinder. The blast should now be shut off, and the iron finished by the ordinary draught in the usual manner, or the heat may be raised and lowered, as required, in the way above described. The damper over the fire-bridge is to be raised and lowered from time to time, to increase or lower the heat of the puddling chamber, as may be found requisite.

The patentee says he does not claim the application alone either of blast or steam in the working of an ordinary puddling or other furnace; nor does he confine himself to the details shown and described above, so long as the peculiar character of his improvement be maintained. He claims as his improvements in making bar or wrought iron the use of hot or cold blasts with steam jets, and hot or cold blasts with the damper described, or with the ordinary damper in the draught of the chimney, to regulate the heat in the said puddling chamber; and he claims the use of hot or cold blasts and steam jets, and steam jets themselves, to regulate the heat in the said puddling and preparatory chambers respectively, instead of the ordinary damper.

James Nasmyth's patent is granted for "An improvement in the puddling of iron," and is dated the 4th of May, 1854. The specification runs as follows:—

"In order that the nature of my invention may be more clearly understood, it may be well to explain the object and present mode of effecting the operation which in the manufacture of iron is termed 'puddling.' With this view I may premise that cast iron owes its distinctive properties from wrought iron chiefly to the presence of carbon existing in combination in some peculiar condition with the iron. It also contains silex, sulphur, and other impurities, from which wrought iron is in great degree free. To convert cast iron into wrought iron, it is requisite to free the iron more or less from the carbon which it contains, and in doing so it is also desirable to drive off the other impurities combined or mixed with the iron. One process by which this object is accomplished is termed 'puddling.' It consists, in the first place, in raking backwards and forwards molten cast iron in a furnace, the tool or instrument employed to effect the raking being called a 'rabble.' This raking backwards and forwards of the molten cast iron puts it into a state of agitation, and thus successively exposes fresh surfaces of the molten metal to the action of a current of atmospheric air, which the draft of the furnace carries over its surface. The carbon of the cast iron thus becomes oxidated, and passes off in the condition of carbonic acid and carbonic oxide. On the continuance of this agitating action for a sufficient length of time, the cast iron begins to lose its fluidity to a certain extent and becomes thick and pasty, shortly after which granulated particles of wrought or malleable iron appear in the scoria. These particles, which the puddling and decarbonizing process just described has converted, are afterwards formed into balls and brought out of the furnace, to be hammered or squeezed into blooms or bars in the usual way. The object, therefore, of the process termed 'puddling' is to remove the carbon from cast iron, and so convert it into malleable or wrought iron; and, as is well known, the operation is a very laborious one, requiring long and violent manual exertion with little intermission. It will, therefore, be evident, that if with due economy the oxidation of the carbon of the molten iron can be expedited without injury to the quality of the wrought iron resulting from the operation, an important improvement will be effected in the puddling of iron. Now, my invention relates to a process of puddling iron, whereby not only will the disengagement of the carbon from the molten metal be greatly expedited, but the quality of the iron will also be considerably improved. In carrying out this invention I subject the molten cast iron in the puddling or refining furnace to the action of a current or currents of steam, introduced as nearly as practicable to the lowest portion of the molten iron, and thence diffused upwards, so as not only mechanically to agitate the molten iron, and thereby keep exposing fresh surfaces of the iron to the oxygen contained in the atmosphere passing through the furnace, but also, when brought into contact with the incandescent iron, to be reduced to its elements and yield oxygen, which will chemically combine with the carbon of the iron as well as with the sulphur or other oxidizable substances of the iron with which it may come into contact and have affinity, and thereby deprive the iron of those impurities, whilst the other component of the steam simultaneously liberated, namely, hydrogen, is free to combine with any sulphur present in the furnace, whether as an ingredient in the iron or as a product of combustion of the fuel employed for heating the iron, and thus substances very prejudicial to the quality of the iron will be removed or prevented from combining therewith, whilst, at the same time, the operation will be materially expedited. * * * *

"The mode of operating with this apparatus is as follows:—The metal having been brought in the ordinary manner to a molten state, the steam pipe is introduced by the attendant through the rabble hole into the fluid metal, its orifice being submerged or kept below the surface of the metal. He then moves the pipe about in the metal like a rabble or rake, and thereby causes the steam to escape into the metal at all parts of the bed of the furnace. By thus distributing the steam throughout the body of molten metal, the steam will, as above stated, be resolved into its elements immediately on coming in contact with the metal, and will cause the upheaving of the metal, and effect a rapid and continuous disturbance thereof, and its components will enter into chemical combination with more or less of the carbon and sulphur present in the iron.

"When the metal has been brought into a condition sufficiently decarbonized or thickened, as to which the judgment of the workman will be his guide, the steam pipe is to be removed, and the ordinary method is adopted for the purpose of gathering the metal into balls, preparatory to the removal of the same from the furnace to the tilt hammer or rolls. By these means the operation of puddling is rendered much easier to the workman, and more uniform and certain in its results, whilst the time in which it is effected is shortened, and the purity, toughness, and strength of the iron resulting are increased in a remarkable degree."

The patent of Joseph Gilbert Martien, of Newark, New Jersey, United States of America is granted "for the invention of improvements in the manufacture of iron and steel," and is dated September 15, 1855. The specification is as follows:—"This invention has for its object the purifying of iron when in the liquid state from a blast furnace, or from a refinery furnace, by means of atmospheric air, or of steam, or of vapour of water, applied below, and so that it may rise up among, and completely penetrate and search every part of the metal prior to the congelation, or before such liquid metal is allowed to set, or prior to its being run into a reverberatory furnace, in order to its being subjected to puddling, by which means the manufacture of wrought iron by puddling such purified cast iron and also the manufacture of steel therefrom in the ordinary manner are improved.

"In carrying out my invention, in place of allowing the melted iron from a blast furnace simply to flow in the ordinary gutter or channel to the bed or mounds, or to refinery or puddling furnaces in the ordinary manner, I employ channels or gutters, so arranged that numerous streams of air, or of steam, or of vapour of water, may be passed through and among the melted metal as it flows from a blast furnace.

"I prefer, in carrying out my invention, that the ordinary process of refining iron by the use of a refinery furnace should be dispensed with, and that the purifying of the iron should be accomplished by subjecting the melted iron from a blast furnace before it is allowed to congeal, to the action of streams of air or of steam passed up through and among the melted metal; at the same time I would state that where it is preferred by others still to resort to the ordinary process by remelting, then my invention is to be applied to the melted metal as it flows from such furnace to a bed or moulds, in like manner to what I will now describe as applicable to a blast furnace. The channel or gutter employed may be of any suitable material, but I prefer it to be of cast-iron, the bottom part being made hollow to receive steam, or air, or both. This gutter is perforated with numerous holes, which I prefer to be inclined, so that the streams of air or steam may be forced through the melted metal (as it flows along the gutter) in an oblique direction, but, by preference, in the direction in which the metal flows. This, however, is not essential, as the streams of air or steam may be passed directly up or through the melted metal; or the holes may be inclined in the opposite direction, so as to oppose the flow of the melted metal. When hot blast or cold blast is used, I prefer to connect the hollow bottom of the gutter with the air pipes used for supplying the blast, and, when steam is employed, I connect the hollow bottom of the gutter with the boiler used. By this means the air or steam introduced in the hollow bottom of the gutter below the metal will rise up, and be forced through it in numerous streams; or, in place of the gutter being the means of applying streams of air below the fluid iron as it comes from a blast furnace, the moulds or beds into which the iron is received may be arranged with means for introducing air or steam below the melted metal, and to divide such air or steam into numerous streams, so that the iron may be purified thereby after it has come from the blast furnace, and before the congelation of the liquid metal takes place.

"The gutter or channel above mentioned may be covered over for any part of its length, and it may be arranged in a suitable manner to admit of heat being applied to the metal therein; and such is also the case with respect to the moulds or bed in order that heat may be continued to the fluid metal after it has left the blast furnace, and while the process above described of purifying the metal is going on. The iron thus purified may be allowed to cool in the moulds, or it may run from the gutter, channel, or receiver, into a reverberatory or suitable furnace, to be highly heated therein, and may be puddled in the ordinary manner.

"I would remark that I am aware that it has before been proposed to use streams of steam in puddling and refinery furnaces in such a manner as to come in contact with the surface of the melted metal therein; and it has also been proposed to introduce steam below melted iron when puddling the same. And I mention these cases in order to state that I make no claim thereto; but what I claim is, the purifying iron from a blast furnace or a refinery furnace while still in a melted state, as herein described."

Mr. Bessemer has taken out several patents relating to iron and steel, respectively dated January 4, 1856; February 12, 1856; March 15, 1856; May 31, 1856; August 19, 1856. The one dated in February is specified, but the specification is not yet printed. The subsequent patents are not specified.

The January patent is granted to Henry Bessemer, of Queen-street-place, New Cannon-street, in the city of London, "for improvements in the manufacture of iron and steel." In the specification he says:—

"Now the object of my present invention is the more perfect and complete refinement of the iron, whereby it gradually loses the properties common to pig or crude iron, and acquires the properties of cast steel, or of pure or decarbonized iron, while it still preserves such a state of fluidity as will admit of its being cast into ingots or other desired forms or articles by the process of founding; for which purpose I expose the iron in a more divided or extended form to the intense heat of the furnace or furnaces hereinafter described, and to the oxidizing action of a blast of air, by keeping such fluid metal in motion and continually bringing fresh portions of it in contact with oxygen and with the intensely ignited fuel, or with the highly heated interior surface of the furnace, the metal being thus kept in a fluid state until the desired amount of decarbonization or refinement is arrived at.

"The iron to be used for the purposes of my present invention may be conveyed by a gutter in a fluid state direct from the smelting furnace, where it has been obtained from the ore, and be allowed to flow into the improved furnace or furnaces hereinafter described, or it may be obtained from any convenient form of remelting furnace, or the iron may undergo a previous partial refinement in the old or in any convenient way; and which iron I proceed to complete the refinement of in any one of the following modifications of apparatus.

"Having thus described my invention, and the manner in which the same may be carried into effect, I desire it to be understood that I do not confine myself to the precise details herein specified, provided that the peculiar character of my invention be retained; but what I do claim, firstly, is the conversion of fluid crude iron into steel or into malleable iron by exposing the metal to the decarbonizing action of currents of air in furnaces, through which the metal is allowed to fall for that purpose. And also, in the manufacture of iron and steel, the alternate rising and lowering of two furnaces, so as to allow the fluid metal to flow from one to the other in the manner, and for the purposes, before described.

"Secondly—I claim, in manufacturing malleable iron and steel from crude iron while still in a fluid state, the use of revolving furnaces, having apparatus in the interior for the purpose of elevating portions of the metal, and allowing it again to fall in streams or showers when exposed to the action of currents of air passing through the furnace.

"Thirdly—I claim, in the manufacture of iron and steel, the suspension of the fluid metal in the furnace by means of centrifugal force generated by the rotation of such furnace, and the forcing into, through, or upon the fluid metal so suspended currents of air or steam.

"Lastly—I claim the manufacture of bars, rods, or plates of steel by the cementation of bars or rods of malleable iron that have been obtained by the direct conversion of crude iron into malleable iron, and while still in a fluid state cast in suitable moulds."

ON TONNAGE REGISTRATION AND MERCANTILE STEAM TRANSPORT.

The following article has been received from the Editor of the *Mechanics' Magazine*:—

It would seem that the object for which Mr. Atherton has been long agitating has now assumed something of a practical form, as a Committee has been appointed by the British Association for the Advancement of Science to consider the question of measurement of ships for tonnage, and other questions of a cognate character. We do not quarrel with the composition of that Committee, for along with the names of Messrs. Atherton, Peake, and Henderson, who have committed themselves to certain views, we observe the names of other gentlemen, some of them eminent for scientific ability, and others for skill as practical shipbuilders, which holds out a prospect of impartiality in the conduct of its deliberations. We would venture to remind the Committee so appointed, that a duty of no small responsibility is intrusted to them; for it is in their power, according to the spirit and judgment displayed by them in the exercise of their functions, either to further or seriously damage the cause of science as connected with the art of ship-building. Those members of the Committee especially who represent mainly the scientific element in its composition, would do well to bear in mind, that the cause of science would be damaged rather than served by any attempt to attain a scientific object, irrespective of the important modifications which the legitimate interests of shipbuilders and shipowners demand; and that a moderate advance, if attainable, is more really useful than the most *perfect system* which is practically unattainable.

The first thing the Committee will have to do, is to obtain a clear insight into the question as it at present stands, and the real objects proposed for its consideration.

It was with this view that Mr. Atherton laid before the British Association the paper which we published in Numbers 1724 and 1735 of our Magazine, and we now propose to give a short *resumé* of these objects for the benefit of our readers.

First, then, we must congratulate Mr. Atherton on the greatly improved tone of his observations as laid before the British Association, compared with his paper read before the Society of Arts, on May 16, 1855, and January 16, 1856. That exuberance of philippic in which Mr. Atherton revelled in these two extraordinary documents, has been happily submitted to the healthy discipline of the pruning knife, and the weak points of his previous suggestions are carefully kept out of sight. We can indeed clearly trace throughout his last volume the wholesome effects of our articles published in April, May, and June last, and we are convinced that Mr. Atherton is now in a much safer path for the securing of an impartial and unimpassioned consideration of the scientific features of naval architecture and steam transport economy, than he was after his indiscriminate attack on the Mercantile Shipping Act of 1854, in January last.

The questions to be considered by the Committee of the British Association are twofold:—

First, the defects of the present system of registration of tonnage and of steam power.

Secondly, the best mode of applying a remedy for these defects.

Now, with regard to the first of these points, Mr. Atherton is more successful than he is in the second. It is always easier to detect defects than it is to raise a faultless construction. In his observations on tonnage registration, laid before the British Association, Mr. Atherton carefully separates the scientific from the fiscal view of this question, and herein we think he has acted wisely. In summing up the objects which he considers would be served by his paper read before the Society of Arts in January, he says: "By this paper I brought forward certain suggestions for public consideration and discussion, with a view to our official registration of shipping being rendered more comprehensive for the fulfilment of the various useful purposes to which statistical registration, if complete, would undoubtedly conduce in a scientific point of view, *irrespectively of merely fiscal objects*."

We rejoice to find that, in accordance with our suggestions, Mr. Atherton now brings his position forward, as *in addition to, not subversive of*, the tonnage registration of the Act of 1854. Allowing, therefore, the measurement for fiscal purposes to remain on its present basis, it will be for the Committee to consider whether the interests of the public do not demand the enactment of a further registration *solely* with a view to scientific objects.

Some definite displacement of a vessel, involving the settlement of the whole weight when fully equipped for sea, is a necessary datum for any scientific inquiry. It may then be a question worthy of consideration, whether the constructor of every vessel may not be required to furnish to the Board of Trade, for the purpose of registration, what he designs to be the vessel's load displacement, which, in all probability, will not be practically either much exceeded or much fallen short of.

It appears, from Fincham's "History of Naval Architecture," as Mr. Atherton has several times reminded us, that in vessels of war the constructor always fixes and calculates the load displacement; and there seems no reason why this course should not be pursued with regard to merchant ships.

It is a further and a very different question whether the owners of ships should by law be prohibited from loading their vessels beyond this load displacement. It would be better, in our opinion, to keep this part of the question entirely separate from that which bears a scientific aspect. While shipbuilders and shipowners might, and probably would, resent any attempt to fix by legislative enactment the exact limit to which vessels *might* in any case be loaded, we do not anticipate any great repugnance on their part to register what may be taken as the mean fair load of the ship, which is all that in a scientific point of view is of importance. It is probably the case, as Mr. Atherton observes, that there is some little ambiguity at present as regards the term *tonnage*. The measurements under the several acts of 1783, 1833, and 1856, are essentially different; but then it must be borne in mind, that only the two latter of these have any reference whatever to the *registered* tonnage of ships; the former has only been preserved to enable persons interested in shipping to form *some idea* of the size of a vessel. As we have said on a former occasion, no legislative enactments can be devised to protect the buyers of ships from the losses incident to want of common sense and common experience. There must be something to learn in every trade, and we are confident that shipowners and shipbuilders laugh at the idea of persons engaged in the act of buying and selling ships professionally being confused between the several meanings which the term tonnage may bear. No person has a right—morally, of course, we mean—to engage in transactions of this kind, unless he is acquainted with the technicalities of the trade, any more than a person has a right to deal in drugs unless he knows the difference between Epsom salts and strychnine. The shipping interests require no protection of this kind, nor can they be expected to receive without suspicion specious offers of protection which they have never asked for, and which they must imagine cloak some ulterior objects which bode them no good. *Timeo Danaos et dona ferentes.*

A knowledge, however, of the weight of cargo *designed* to be carried by each ship, being the difference of the constructor's registered load displacement and light displacement (if it should please the legislature to require such registration), would supply all the information that could be fairly required for statistical purposes.

So much for the defects of the law as regards tonnage registration.

It seems, however, that the registration or calculation of horse-power for mercantile purposes is equally defective. Mr. Atherton, we think, has fully succeeded in establishing this part of the case. The nominal horse-power of an engine gives no indication whatever of the real power to which it can work, for while some marine engines will work only up to twice, some will work to four times the nominal power. It is, therefore, evident that from a knowledge of the nominal horse-power of an engine, no inference can be drawn of it as to its efficiency. To test the value of a vessel propelled by steam in a mercantile point of view, we require to know the *weight* propelled and the power actually exerted in propelling it, and also the *speed* at which it is moved. Hence, it will be for the Committee to consider, whether it would not be for the public advantage, that some more efficient mode of estimating the real power of an engine is not a desideratum, which the legislature may fairly be called upon to supply.

But although we agree with Mr. Atherton, that in a scientific point of view, a more correct mode of estimating horse power is required, we are by no means convinced that the competition amongst engine makers to produce engines which under the smallest possible compass shall give the greatest power, has not been attended with advantages greatly counterbalancing the admitted defects. So far from believing that every fresh vessel of improved form and steam power application only benefits the owner, by giving him the same freight which the vessel of bad form is obliged to charge for the indemnification of the owner, we believe, on the contrary, that the advent of every such vessel tends to lower freights; not perhaps to such a degree as would be the case were none but vessels of good type in the field, but so as to give the public a good share of the advantages resulting from the adoption of good types of build and efficient adaptation of steam power, and so as in a moderate number of years materially to lower the average freight charge for every ship. It is impossible that the average freight should be that of the vessel of the newest and most improved type; all that may be fairly demanded is, that in order to compete with such a vessel, which for the interests of the owner would carry cargo at a lower freight than other ships, the builder must construct all new vessels on *improved*, and not on bad, or even indifferent lines.

This, we believe, to be the history of the great improvements which have undoubtedly been made in mercantile steam shipping of late years. And it is, we believe, doubtful whether under the present system the public interest has not been consulted as efficiently as though "the statistical grindstone" had been as perfect a machine as possible. At all events, we think Mr. Atherton has somewhat overstated his argument in this part of his case.

We do not purpose entering here upon an examination of Mr. Atherton's arithmetical calculations, and of the formula on which those calculations are made. We are content to allow that, without being strictly in accordance with theory, the formula in question is practically sufficiently well adapted for the purpose, and that Mr. Atherton's calculations are not far from the mark.

That there are such *deficiences* in the registration of tonnage and horse power as to render all scientific inferences drawn from these data valueless, must be admitted. If it is advisable to enforce by legislative enactment a remedy for these defects, the next question, and that one of no small difficulty and delicacy for the Committee of the British Association to consider, will be in what form can that remedy be best supplied? Mr. Atherton, in his previous paper and essays on this subject, has suggested remedies which he has formally laid before the Committee. We have so lately examined the value of his improved registry for tonnage, that we do not think it necessary to enlarge on that topic now. Suffice it to say, that the registered load displacement, to serve every scientific purpose, must be as accurately calculated as the most approved modes of approximation will allow: and, as we have fully shown, Mr. Atherton's proposed method is a signal failure, as far as regards this most important element.

To remedy the other defects in the marine horse power registration, Mr. Atherton simply proposes to substitute the unit of 100,000lbs. raised 1 foot high per minute for that of 33,000lbs. so raised. The particular unit of 100,000 is fixed upon, because it appears that the real horse power developed varies between two and four times the nominal power.

But, how would the adoption of this new unit bring the nominal and real power into complete harmony. Still the nominal power of some engines would be 33 per cent. less, and others 33 per cent. more than the real power. What is required is, that the registered horse power or nominal horse power should really represent the effective horse power, so that the numbers representing these quantities should be sufficient data for making a true comparison of the locomotive merits of different ships. *Any unit whatever* would answer this purpose, provided the nominal power and the effective power were represented in each separate case by one and the same number of such units. The only advantage that we can see in adopting the new notation, would be to diminish the number representing the indicated horse power, and so to raise the co-efficient C in the formula $\left(\frac{V^3\ D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C\right)$ to about three times the value it would otherwise have; and to bring the nominal and real horse powers to coincide to within one-third of the whole amount in excess or defect. Whether it is worth while to unsettle the present system merely to adopt *such an improvement*, we leave our readers to judge. It appears to us that Mr. Atherton would have done more service to science, and would have put the committee on a better track, had he brought his experience and his means of procuring information from engine makers to bear upon the question of establishing some such relation between the proportions of the several parts of the engine *and of the boilers*, as to deduce a rule for the calculation of nominal power which should be at the same time the effective power of the engine.

As to Mr. Atherton's proposed unit, it seems to us to be a matter of perfect indifference whether it be adopted or not. The real desideratum remains as much a desideratum as ever.

Such, it appears to us, is the present state of this question, so much agitated of late by Messrs. Atherton and Henderson. Such, as we have endeavoured to faintly point out, is the nature of the investigations which it is incumbent on the newly-appointed Committee of the British Association to pursue. In conclusion, we would again express our opinion that they will best serve the cause of science by keeping a broad and well-defined distinction between the scientific objects sought to be attained, and any legislative enactments which may have for their end to compel the shipowner not to exceed a certain specific limit in the loading of his ship.

THE SALFORD ROYAL MUSEUM AND LIBRARY.

Several weeks have lately been occupied in considering the plans, and making the necessary arrangements for building the new south wing. In reply to the architects' advertisement, tenders from several of the principal builders in Manchester and Salford were sent in, all of which, however, were found to greatly exceed the estimated cost; and it became necessary to give the architects (Messrs. Travis and Mangnall) directions to make several alterations, and to take out much of the extra ornamental stonework over the windows and parapet, so as to reduce the cost, without at the same time sacrificing any of the essential details of the plan first adopted. By this change the new wing will be made nearly uniform with the present wing, retaining, however, the new entrance-door and corridor. The tender of Mr. G. Harrop, Ellesmere Works, Chester Road, the builder of the Free Trade Hall and Mechanics Institution, to complete the whole work for the sum of £2,552, has been accepted, and there is every reason to believe that he will be able to accomplish the work, and give up the building into the hands of the committee, within the time specified in his agreement, so that, very early in the spring, the rooms may be in a fit state for the committee to commence casing and filling with the objects they may be able to exhibit during the summer of the ensuing year. In what manner all the rooms will be filled it is as yet rather premature to state, at least with any degree of certainty; but, for the present, the intention is mentioned of reserving the large upper room for an exhibition which shall possess a local character, having sufficient novelty to secure a large amount of public interest.

The ground floor room it is intended to divide into two, by a partition in the centre, so as to reduce the room to a more convenient and suitable size; and it will be hung with engravings, drawings, and small paintings. The museum already possesses a large collection of engravings, many of which are framed and glazed; but to add to these and give them greater interest, Mr. Alderman Agnew has promised to render most valuable and efficient aid, by donations and loans from his extensive emporium of art. The new corridor, with the entrance, will form a chaste architectural feature in the new wing, and will be most admirably suited to the display of casts from the antique, and statuary; and the basement room will most likely be fitted up for the geological collection (which will be removed from its present room, as that room will be required for the lending library), and for models of machinery, works, and other large objects. It will be apparent that by this enlargement of the museum building, the room for the display of objects will be more than doubled; and without great exertions on the part of the executive committee, and a large measure of support from the public in donations of objects, which it is trusted will be given, their efforts will be marred, if not altogether unsuccessful, in making an attractive and satisfactory exhibition for 1857. In addition to the building of the new wing, it is intended to pull down the present old and dilapidated portico on the east point, and to build another after the design of Mr. Walters, architect, Manchester. This design is of the Doric order of architecture, and will be entirely of stone. It shows four fluted columns, with a broad flight of steps approaching from the front only. The entrance-door will be widened to eight feet, and the vestibule made to correspond and harmonise with the architectural details of the new portico. This will be an additional expense, but a decided improvement, and prove a great convenience, especially at holiday times, when the visitors throng into the building at the rate of 3,000 in the hour.

The general progress of the library and museum, as evinced by the returns which, since its commencement, have so frequently been laid before the public, forms the best evidence from which to estimate the amount of moral aid which it must have rendered to the cause of the improvement and education of the working classes.

It now possesses an excellent library of modern literature, to the extent of 18,000 volumes, and has issued the large number of 410,000 of its volumes to the readers who daily frequent the reading-room, and it is most gratifying to know that this circulation has not been made up of light and trashy reading, as the returns enable us to show that whilst even less than one-third of the books belong to novels and light literature, and about the same proportion to general literature, the best and largest portion belong to history, biography, science, and art, and with the higher branches of literature. It has also been found, from taking the last three years into consideration, that about 400 readers frequent the reading-room daily. The library has been materially increased during the present year, and much attention has been paid to that department which is allowed to circulate to the homes of the people. The appreciation of this library is far greater than had ever been thought possible when it was first established, and the demands made upon its 5,500 volumes are almost equal to its entire circulation every month, and now make a total of 105,000 volumes issued since it opened. A single examination of its returns is sufficient to prove the amount of interest they possess, and the measure of the improvement which is gradually taking place in the taste for reading among its 2,300 borrowers.

The classification of the issues shows that three-fifths of the borrowed works are light and pleasant tales, novels, and romances, and that the remaining two-fifths are works upon history and other sound books. It appears that nine-tenths of the privileged borrowers are working people, or at least belonging to the working classes: that three-fifths of them are at the hopeful period of life for improvement and self-culture, being under 30 years of age; that one-fifth of the entire number are young females, and 150 are soldiers of the 25th Regt. now stationed at Salford-barracks. Such is a bare abstract of the returns from this active and popular free library.

The visitors to the museum are so numerous, and one day so much like another, that it is a fair and unexaggerated average estimate to say that about 2,000 people visit its rooms every day in the year.

DECAY OF STONE.

Mr. H. H. Burnell, in a letter to the *Times*, says:—

"It may be useful to invite attention to the method which has for some time past been adopted by the French to remedy this evil, and the more so because it has been employed at the Louvre, Notre Dame, and in other important works, with apparent success, up to the present time,—I allude to the application of the silicate of potash. Its manufacture and use may be briefly described as follows:—2¼ parts of silica (flint or clean sand) are fused with one part of potash; it is then dissolved by boiling (under pressure) in from eight to ten times its weight of water.

"The stonework of old buildings is thoroughly cleansed of all that might prejudice its absorbing qualities. Troughs hugged with clay are placed against the part of the building intended to be silicated, so as to collect the solution, which is applied with a syringe at intervals of three or four hours for about four days, or till the stone (when dry) ceases to absorb.

"It is considered desirable that this process should be repeated, but to a less extent, the following year. The colour of the stone is not materially changed, provided the absorption is tolerably equal and the silicalization effected by a sufficient number of applications of weak solutions, both of which conditions are necessary to success.

"The phenomena of induration is thus explained by M. Kuhlmann:—The carbonic acid of the atmosphere separates the silica from the potash, leaving it deposited in the pores of the stone, when, should the carbonate of lime be present (as in limestone), it combines with it and forms the silicate of lime, while the soluble salt—viz., the potash, is removed by the rain or other means. The price at which this work is undertaken in Paris is 1s. 3d. per superficial yard.

"I am aware that this process of silicalization is reported to have been tried without success at the Houses of Parliament, but, as it has been for some years past, and still is, employed advantageously in the instances I have named, as also in other important works in France, and has much philosophical reasoning in its favour, it may still be worthy of the consideration of those learned and interested in such matters."

AMPHIBIOUS CARRIAGES.

The following letter, as bearing on the question of metallic waggons and pontoons, is republished from the *United Service Journal*, at the request of Lady Bentham, who solicits "the insertion in the *Journal of the Society of Arts* of Sir Samuel's own ideas of the advantages which would accrue from the use of amphibious military baggage waggons, as already published in the *United Service Journal*, a publication not likely to be in the hands of mechanists." Her ladyship says: "It is but just that Mr. Francis should reap the profits of a skilful manufacturer, though not that he should be rewarded for the repeatedly published inventions of Sir S. Bentham. All the details of artillery amphibious baggage waggons were furnished by him to the Duke of Wellington, through his friend Sir Herbert Taylor."

To the Editor of the United Service Journal.

October 8, 1829.

SIR,—In looking over the copies of my letters to my friends in England, written during my stay in Russia, between forty and fifty years ago, I met with some accounts and drawings of an amphibious carriage I constructed in Siberia, which afforded me much convenience and pleasure during journeys of several thousand miles in that country. Conceiving that carriages constructed on a similar principle might become useful to travellers of the present day, and as no account of them has, I believe, ever been published, I herewith enclose extracts from such parts of my letters as relate to this subject, together with a drawing of the first amphibious carriage which I made use of.

This carriage was built during my first visit to Siberia, in 1781. Some years afterwards, whilst in the Russian service, having requested and obtained leave to exchange my regiment at Cherson, for a command in Siberia, consisting principally of two battalions, stationed one of them at Kiachta, on the frontiers of China, the other along the banks of the Irtish, above 1,200 miles from each other, the amphibious carriage presented itself to me as peculiarly suited to the enabling me to vary my route in passing from one to the other. I, accordingly, constructed two carriages of more simple form than the first, in which, while travelling post, I crossed several rivers without any stoppage at the banks, the horses continuing their course across the river, swimming whenever they got out of their depth.

On my return, in these carriages, from Siberia to Prince Potemkin's head-quarters at Jassy, previously to the taking of Ismailoff, the Prince, impressed with the importance of amphibious carriages in a military point of view, ordered a corps of chasseurs to be furnished with some of them, according to the general idea I gave of the requisite modifications, but as I then obtained leave of absence to visit my friends in England, I did not stay to direct the correction of some imperfections I observed in the only one I saw. I never returned to the service of Russia, and Prince Potemkin dying soon afterwards, it does not appear that any further steps were taken towards the adapting those vehicles to military purposes.

On my return to England I constructed a model of a military baggage-waggon on the same principle, which the late Duke of York saw at my house, together with some of my mechanical contrivances. On this occasion his Royal Highness suggested some improvements of his own, according to which a carriage was executed, and exhibited on the Thames above bridge, when his Royal Highness seemed determined to make use of this invention, but as I was at that time completely engaged in the duties of my office of Inspector-General of Naval Works, I neglected to draw any further attention to the invention. At a later period during my mission to Russia, the Emperor Alexander caused a carriage of this kind to be constructed, a model of which I suppose to be the one mentioned by Dr. Granville, in his account of St. Petersburg, as being deposited at the Admiralty. This carriage was several times tried on the Neva, but the Emperor wishing to see it further improved, so as to be adapted to the sick and wounded, and as I was at that time called home, I do not believe that the idea has been any further pursued.

The materials of which these several carriages were constructed were such as the different places afforded. The ribs were formed of ash, or other tough and flexible wood; the planking of the first was composed of two strakes, of three-tenths of an inch thick, placed diagonally, crossing each other at right angles, with a stratum of thin linen impregnated with tar between them. In other carriages, instead of the planking, the ribs were covered with raw hides, which, after being affixed, were smoked by burning sawdust under them for a week, a mode of preparing leather for boots, practised in some parts of Russia, instead of tanning. The amphibious baggage-waggon made according to the instructions of the Duke of York, was of tinned copper.

If these amphibious carriages were adapted for military purposes, supposing that all the carriages attendant on a regiment were constructed on the same principle, and that the number be the same as was in the Russian service, there would be in constant readiness a sufficiency of water conveyance to enable the whole of the *personnel*, as well as the *matériel*, to cross any river without further stoppages than the time necessary to take off the covers from the carriages, turn them upside down, and embark on board them; and so far from any addition being required to the usual number of horses, these carriages, from the superior lightness of the construction, would actually need a less number than are usually employed. But even if the number of amphibious vehicles furnished means for no more than one-half of the *personnel* to pass a river at a time, they would be found exceedingly useful, and if similar means were adopted for passing the artillery in a state ready for immediate action, such an advantage might, on many occasions, be made productive of most important results.

I am, sir, your very obedient servant,
SAMUEL BENTHAM.

[Here follow three sketches of the ship-carriage in its several forms.]

Home Correspondence.

THE BESSEMER IRON.

Sir,—F. E. W., dating from Woolwich Arsenal, gives in the *Society of Arts Journal* the first detailed account of experiments on forged iron produced by Mr. Bessemer's process which I have seen in print. The bar he describes is 2 inches wide and 5 inches thick. The bar alluded to in my letter in the *Times* of Sept. 9th, was seen by me and many others at Baxter-house at the experiments of Monday 7th. It was some 15 feet long, 2 inches wide, and bare half-inch thick. One end of it was bent round cold to a circle of 6 inches diameter, displaying considerable toughness, and being bent backwards, a piece was broken off, which was carried away by a friend of mine to experiment on. The fracture showed white and large grained crystals. I inquired where the iron was rolled, and was informed, at "Woolwich Arsenal," being first tilted to a "bloom."

I enclose a piece of the bar, which has been partly cut through and broken. The broken part is crystalline, the portion between the break and cut is laminated, as described by F. E. W. To the file the iron is perfectly soft, without "pins" or hard particles, and with the back edge of a penknife small filaments are easily removeable; these are mechanical indications analogous to those of charcoal iron. The quality apppears to be homogeneous, but the lamination shows mechanical separation of parts, that is want of solidity, or porosity. But, nevertheless, it takes a very beautiful polish. The chemical analysis is given by F. E. W., but it would have been more satisfactory had he given the comparative analysis of the other irons against which it was tested. Nothing is said of specific gravity—an important element.

In the breaking experiment Bessemer's iron proved crystalline, the other four were fibrous. It is, therefore, certainly very remarkable how closely the crystalline approaches to the samples of two of the best fibrous in strength, while it exceeds the other two. This is a very important matter, for granular iron is, for many purposes, preferred to fibrous, as for the tyres of railway wheels, wherein fibre laminates and treads out into strings, and is only endured in frosty climates, as Russia and Canada.

Those who have witnessed the casting of the ingots will have remarked that the blast which permeates the mass of molten iron is continued during the process of pouring out. In fact, it pours out, aërated like so much champagne, and is received in a cast iron mould, which tends to chill the mass on the outside and leave the centre reedy and hollow. Probably this plan has been adopted from its quality of showing the experiment rapidly, without having to dig the ingot out of the sand. The best plan has not yet been adopted for obtaining dense ingots. In castings, it is customary to let the metal rest before pouring out, and to cast with what is called a "head," squeezing out the air bubbles below, with weight of metal above. Even in brass this is done. But Mr. Bessemer's castings have hitherto apparently all been made so as to ensure the least density in the ingot. Globular pores appear to be squeezed flat in rolling, and to induce lamination, analogous to beating up small shot into a mass.

The experiment at Woolwich,—reheating a cooled ingot—does not seem favourable to the production of dense non-porous metal. Once set, it is probably difficult to close the pores in the interior of a mass, just as it is difficult to make a cool rivet fill a hole. The external part feels the influence of a blow or pressure, which does not get to the interior.

Probably, the best method would be, after allowing the metal to subside to cast it in heated moulds; to form a vacuum while subsiding, and to put the mass under pressure as soon as it may be set, and then transfer it to the hammer and rolls.

What is fibre in iron? In wood, fibre is a mass of strings held together by a gummy substance, while in a woollen cord the fibres are held together by twisting. Probably, then, fibre in iron may be produced by some intervening substance separating the iron into strings in the process of squeezing. We do not yet understand this matter. Granular iron is probably the same as fibrous, with the difference that the intervening substance in fibrous iron lies in one direction in strings, and in the granular in broken strings lying in all directions. Molten gold, silver, copper, and lead, are as homogeneous when cast as when wrought, though not so dense. Probably iron, pure, and absolutely free from any other substance, may ultimately be got to the same condition. These considerations open up the question of what is crystallisation in iron. Lamination is striation in sheets; fibre is striation in strings; crystallisation is striation in irregular network. In neither case is the metal homogeneous; and this opens up the question whether the crystallisation is caused by the molecular arrangement of parts of pure metal, or by the interposition of some other substance. A question to be solved by the chemist, possibly, with the aid of a powerful microscope. But I think it will be found that each separate crystal is pure soft iron. These views are the result of simple thought, without the means of verification at hand.

The great fact in Mr. Bessemer's process is, that in a clay colander he produces, without fuel, an intenser heat than has before been produced with fuel; and by a rapid operation, without manual labour, a result of malleable iron ten times the amount of what has hitherto been produced at considerable cost of fuel by a slow process.*

Since the process became public, I have been informed that an amateur chymist has performed it on a small scale by very simple implements. Running down four ounces of cast iron in a crucible, he poured it into the large bowl of a heated tobacco pipe, using the stem as blow-pipe, till the process was complete. Any of your readers can try this simple experiment.

But it is a fitting proceeding for the authorities in Woolwich Arsenal to exhaust the subject. Without getting ingots from Mr. Bessemer, they should take the ores direct, of various makes of iron, and

First. Reduce them by the ordinary process, and puddle them or refine and puddle them.

Secondly. Reduce them by the ordinary process, and run the iron out into Mr. Bessemer's clay colander and make it malleable.

Thirdly. Reduce them by the ordinary processes, and then with Mr. Bessemer's apparatus subject the iron to every variety of gaseous substance.

Fourthly. Reduce them by the ordinary process, and mix the iron with lime and other substances in Mr. Bessemer's apparatus.

Fifthly. Vary the length of time Mr. Bessemer's process is continued, from the first commencement of scintillation to a period as long as heat can be kept up.

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* Not really without fuel. The carbon is fuel to chemical, but not manufacturing apprehension.

Sixthly. Reduce the ores and mix them with all probable chemical substances in the ordinary furnace.

Seventhly. Provide for the subsidence of Mr. Bessemer's iron by slow process, keeping it fluid as long as may be desirable.

Eighthly. Press samples of each iron in dies to attain the maximum density.

"F. E. W." states that phosphorus and sulphur are found in Mr. Bessemer's iron in nearly the same proportion as in Blaenavon pig, from which it is prepared. Here are two indications of the course to be pursued—first, to ascertain whence come the phosphorus and sulphur—from the ore, the fuel, or the fluxes; secondly, if heat be not sufficient to expel them, what chemical additions are required to neutralise them.

When the experiments are complete, tabulate them, giving the chemical analysis, specific gravity, tensional strength, torsional strength, ductility, rigidity under compression, power of resisting atmospheric oxydation, and comparative cost of production. The last six conditions are the conditions of general utility.

It will not be creditable to us nationally, if our public establishment, our chief arsenal, does not work out this great problem of exhausting the subject of iron production, conversion, and modifications. An individual has at his own cost turned over a remarkable leaf in the great book of Nature, and literally, with "great labour and expense," given us a kind of Rosicrucian alembic, in which fire burns without fuel; and it is desirable that the national laboratory should advance more than *pari passu* with the individual manufacturers in the opening future, confirming or combating the statements which individual interests may be supposed to bias.

Since the first reading of the paper before the British Association, experiment proper there appears to have been none by Mr. Bessemer, but a mere repetition of duplicate meltings before the thronging curious and the thronging interested. I am now informed that a hammer is about to be erected on the premises—not a steam hammer, but an air hammer, *i.e.*, a hammer lifted indirectly by steam with a cam movement, and forced downwards by the elastic action of compressed air in addition to its own gravity. What is commonly called a steam hammer is not really so, but simply a gravitation hammer lifted by steam directly instead of indirectly. We shall thus get to the next stage in the process.

Belief in disinterestedness is not a weakness to which human nature is generally prone, and it would be but worldly wisdom in any one possessing the weakness of disinterestedness to deny it, and assume an interest if he have it not. If he cannot show an ostensible interest in any subject he may advocate, he will be suspected of a concealed one, for the world firmly believes that "nobody gives nothing for nothing." In advocating this new process of iron-making I am fortunately able to fall in with the world's views, having a very strong interest in it, generally as an advocate for the substitution of iron for timber in buildings, by sea and land, and particularly in the application of it to the construction of my own "Suspended Girder Rail," which will then be not merely as cheap, but considerably cheaper in first cost than the wasteful timber structures; and if the "semi-steel" of Mr. Bessemer turns out a true process, we shall obtain a safe, cheap, and really *permanent* way.

I am interested in another thing, in which I believe I am backed by the generally chivalrous spirit of the English nation, viz., that the inventor, who is our constant prop and stay—our watchman—vigilantly guarding us against falling into the condition of Chinese—should have fair play and ample remuneration.

If your readers will refer to the paper of Mr. Kenyon Blackwell, on iron manufacture, read before the Society of Arts, they will notice how very remarkably he hovers round the then undiscovered process of Mr. Bessemer in all his remarks on iron puddling:—

"In some of the largest iron-making districts of Great Britain, the production of one ton of wrought iron of inferior quality is only obtained by the consumption of nearly one-and-a-half tons of crude or pig iron."

"The defects in the boiling process are the following: the wear and tear in the puddling furnace which occurs in heating grey pig iron, particularly that of the more fluid descriptions, the slowness of the operation, and the amount of manual labour which it entails to produce good results."

"It appears desirable to introduce between the blast furnace and the puddling furnace some intermediate process, which, like that of the *mazéage* practised on the continent, shall sufficiently decarbonize the grey pig iron at a small cost in fuel and labour, and without entailing the enormous waste of the coke necessary, so as to enable it to be heated rapidly and without difficulty in the puddling furnace."

I have one more remark to make, not on the humanity—because it is considered bad taste in trade to talk of humanity and to savour of humanitarianism, anti-cruelty to animals, and that "sort of thing"—but on the mere score of political economy, what an important item it is in Mr. Bessemer's process to get rid of the necessity of employing human puddlers. To produce fuel and train a workman to the age of 20 costs a given sum. Puddlers are worn out at 40 years of age; other workmen last till 50 and 60. Therefore, the capital invested to "raise" a puddler is sunk and expended in 20 years, while the same capital expended on other workmen lasts for 30 and 40. Depreciation of human stock is a large item in puddling. I again beg to state that I am talking political economy and not humanity.

I am, &c.,

W. BRIDGES ADAMS.

Proceedings of Institutions.

Almondbury.—A meeting was recently held in the National School-room, Almondbury, for the purpose of establishing a Mechanics' Institution. The attendance was good, and those present were the class of persons who will be more especially benefited by the establishment of such an institution. E. Eastwood, Esq., president of the Huddersfield Mechanics' Institution, presided, T. Mallinson, Esq., the expected chairman, being unavoidably absent.—The Chairman expressed his sympathy with the object of the meeting; spoke of the benefit he had received from the Huddersfield Mechanics' Institution; showed that as people became more educated they obtained more of the substantial comforts of this life; advocated a high rate of subscription rather than a low one; urged the necessity of proper and efficient teachers being obtained for the pupils; inculcated kindliness and unity; and concluded by pointing out the dangers that would arise if the Institution, instead of being a place of instruction, became a mere place of amusement.—Mr. F. Curzon, secretary to the Huddersfield Mechanics' Institution, considered all present had determined to give themselves and their labour to the Institution, and believing the rise of towns, as well as of individuals, was caused by energy, enterprise, and enthusiasm, called upon those present to exert themselves in forwarding an institution which would confer such a vast benefit on the village. He hoped they would make it a Working Man's Institution, and be proud of it as such; and concluded by urging them to be self-reliant, and not to depend upon any assistance but their own.—The Rev. L. Jones, the vicar of Almondbury, cordially concurred with the last speaker.—After a few remarks from Mr. P. H. D. Jones, the meeting was addressed by Mr. Barnett Blake, lecturer to the Yorkshire Union of Mechanics Institutions. He showed how the intelligence, industry, and enterprise of the inhabitants had raised England above other nations; pointed out the necessity for individual and combined exertion to keep the country in the place it occupies; and gave several hints on the best method of managing the new Institution.—Mr. JOSIAH MELLOR moved, and Mr. JOHN RUSSELL seconded, a resolution approving the establishment of a Mechanics' Institution, and naming Messrs. Midgley, J. R. Sykes, J. Mellor, J. Taylor, R. Beaumont, W. Dickenson, and D. Lee, a committee to carry out the resolution, with Mr. G. S. Midgley, secertary *pro tem.*—The names of those desirous of becoming members were taken by Mr. Midgley, Mr. Curzon the vicar, and others, and nearly fifty names were enrolled. Votes of thanks were passed to the chairman, the speakers and the singers, and the proceedings concluded, shortly after half-past ten o'clock, by the Almondbury Glee and Madrigal Union (who had sung several glees during the evening, in a highly satisfactory manner) singing "God save the Queen," in which the audience heartily joined.

LEWES.—The Committee of the Mechanics' Institution, with a view of extending its usefulness, have expressed themselves desirous of establishing classes for affording instruction in various departments of learning, and have issued a circular to the members to solicit their co-operation, from which the following is an extract:—"The Institution being in union with the Society of Arts, its members may avail themselves of all the privileges of the annual examinations of that Society for granting 'Certificates of Merit;' and the Committee hope that such a public recognition of intellectual attainments will greatly increase the number of students among their members. It will be impossible to organize any arrangements without knowing to what extent the Committee may rely upon the co-operation of the members, either as teachers or students; I am therefore instructed respectfully to solicit your assistance in attaining so desirable an object. For the purpose of ascertaining how far the proposal is likely to meet with your sanction and support, the Committee have prepared the accompanying list, and respectfully request you will denote those which you are disposed to join, and state in what capacity." The subjects for instruction in which it is proposed to establish classes, are the following:—Grammar, Geography, Rudiments of Arithmetic; French and other Languages; Geometry, Algebra, Mechanical Drawing; Drawing; Natural Philosophy, Physics; Natural History, Botany; History, General Literature; Chess Conversazione; Vocal Music.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September* 12*th*, 1856.]

Dated 9*th June*, 1856.

1371. William Smith, Hastings—A material for the destruction of flies, gnats, and other insects. (A communication.)

Dated 16*th July*, 1856.

1675. David Bowlas, Reddish, Lancashire—Improvements in "throstles," and doubling frames for spinning and doubling cotton and other fibrous materials.

Dated 25*th July*, 1856.

1765. George Spencer, 6, Cannon-street West—Improvements in the couplings of feed pipes of locomotive steam engines and tenders. (A communication.)

Dated 21*st August*, 1856.

1951. Joseph Hacking and William Wheeler, Clitheroe, Lancashire—Improvements in the mode or method of winding, warping, sizing, and beaming cotton, woollen, linen, or other yarns or threads, and in the machinery or apparatus employed therein.

1953. William Akroyd and John Thompson, Halifax—The manufacture of carpets or other fabrics.

1955. Thomas York, Wolverhampton—A new or improved safety valve and low-water indicator for steam boilers.

1957. William Edward Newton, 66, Chancery-lane—Improvements in pumps for raising water. (A communication.)

Dated 22*nd August*, 1856.

1959. Thomas John Chipp and Richard Bitmead, Soho—Improved apparatus for drilling and boring.

1961. Charles Durand Gardissal, 10, Bedford-street, Strand—A new or improved rotary engine. (A communication.)

1963. Samuel Jay and George Smith, 246, Regent-street—Improvements in ornamenting or trimming articles of outer attire, such as dresses, mantles, bonnets, and the like.

Dated 23*rd August*, 1856.

1965. Philippe Benoist, 7, Rue de Lancry, Paris—An improvement in the construction of stereoscopes.

1967. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in stocking looms. (A communication.)

1969. William Racster, 28, Francis-street, Woolwich—Improvements in apparatus for regulating the supply of gas.

1971. Alexander Moses, Cannon-street-road East—Improved machinery for propelling vessels on water.

1973. James Wadsworth, Hazelgrove, near Stockport—Improvements in the ventilation of mines, and in removing noxious gases or vapours from places in which they accumulate or are generated, and in machinery or apparatus applicable to and to be used for such purposes.

Dated 25*th August*, 1856.

1975. Hugh Dickie, Girvan, Ayr, N.B.—Improvements in machinery or apparatus for cutting or shaping wood or other substances.

1977. William Webb, Wilson-street—An improvement in reclining chairs.

1979. Thomas Marples, Derby—Improvements in corn mills.

1981. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

Dated 26*th August*, 1856.

1983. John Perry, 14, Great Portland-street—Improvements in photography.

1985. William Frederick Bush and William Hewitt, Bristol—Improvements in machinery or apparatus for grinding grain.

1987. Charles Carey, the Parade, Harleyford-road, Vauxhall—Improvements in shower baths.

1989. James Earl of Caithness, Barrogill Castle, Caithness, N.B.—Improvements in cutting or shaping stone and other substances.

1991. Richard Williams Vivian, Camborne, Cornwall—Economizing the consumption of fuel.

Dated 27*th August*, 1856.

1997. Thomas Lees, Stockport—Improvements in lubricating parts of steam engines, and in apparatus and machinery to be applied for that purpose.

1999. Alfred Vincent Newton, 66, Chancery-lane—An improvement in projectiles for cannon. (A communication.)

2001. Israel Colbeck, Batley, Yorkshire—Improvements in machinery for tearing rags, adapted particularly for shoddy or artificial wool.

Dated 28*th August*, 1856.

2004. Charles Durand Gardissal, 10, Bedford-street, Strand—A new manufacture of artificial fuel. (A communication.)

2006. Bernard Augustus Grantoff and Charles Henry William Albrecht, Lime-street-square—Improvements in the construction of pressure and vacuum gauges. (A communication.)

2008. Cæsar Heilmann, 22½, Milk-street, Cheapside—Improvements in furnaces of steam boilers.

Dated 29*th August*, 1856.

2010. John Avery, 32, Essex-street, Strand—Improvements in bellows. (A communication.)

2012. John Randolph Sees, New York, U.S.—Improved apparatus for heating the feed water of steam boilers.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2033. Lazarus Simon Magnus, 3, Adelaide-chambers—Improvements in the manufacture of coke. (A communication.)—1st September, 1856.

2103. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—An improvement in flying or roving frames. (A communication.)—9th September, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed September 12*th*, 1856.

602. William Bramwell Hayes.
627. James and William Rice.
636. John Mitchell.
637. Thomas Palmer.
638. Robert Thomson.
655. John Davie Morries Stirling.
667. William Charles Theodore Schaeffer.
743. William Ward.
769. William Muschamp.
771. Charles Jean le Mélorel de la Haichois.
809. Frederick William Kitson.
839. Ephraim Morris.
871. George Jackson.
885. George Davies.
965. Thomas Jeacock.
1395. John Stenhouse.
1503. Henry Waller.
1533. Henry Brown and Job Bartlett.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

September 9*th*.

2135. Moses Poole.

September 10*th*.

2166. Christopher Nickels and Ralph Selby.

September 12*th*.

2116. Henry Dubbs.
2117. Adolphus Sington.
2118. Alexander Allan.
2331. James Hall Nalder and John Thomas Knapp.
2409. John Norton.

September 13*th*.

2136. George Spencer.

Journal of the Society of Arts.

FRIDAY, OCTOBER 3, 1856.

CLASS-BOOKS FOR INSTITUTIONS.

It will be remembered that the Privy Council were, some time since, pleased to assent to the request made by the Society, by granting to the Institutions, where classes of an educational character were established, the privilege of purchasing books and educational apparatus at the same reduction as is afforded to schools under inspection.

The lists of elementary and school-books were then undergoing revision, which has now been completed, and the following letter has been received by the Secretary:

> "Committee of Council on Education,
> "Council Office, Downing-street, London,
> "Sept. 30th, 1856.
>
> "Sir,—I am directed to inform you that my Lords are now prepared to receive applications for grants of books to evening classes in union with the Society of Arts, in conformity to the regulations which have been already explained to you.
>
> "I have the honour to be, Sir, your obedient servant,
> "HARRY CHESTER.
>
> "P. Le Neve Foster, Esq., Secretary, Society of Arts."

The conditions under which applications must be made are, that the Secretary of the Institution should, in each case, correspond directly with the Committee of Council; but with the application he should file a certificate from the Secretary of the Society of Arts, stating that the Institution is in union with the Society of Arts, and that the Council of the Society recommends its application, it being understood that no classes will be recommended to the Committee of Council except those in which regular instruction is the characteristic feature; that the class will be open to the visits of her Majesty's Inspectors; that, if scientific apparatus be applied for, a competent lecturer will be engaged, *i.e.*, that the class will not depend for its scientific instruction upon itinerant lecturers alone; lastly, that the premises and furniture will be reasonably convenient for the purpose.

Further particulars, with reference to the mode of application, will be published as soon as the necessary forms have been received from the Privy Council Office.

SUBJECTS FOR PREMIUMS.

The Council, in issuing the subjoined List of desiderata, would urge upon the Members of the Society generally, and others, the importance of communicating detailed accounts of new processes in the Arts or methods of Manufacture, of any new Mechanical arrangement by which these may be simplified, or labour saved, and of any novel application of Raw Materials, whether previously known or not, to useful purposes. It is quite possible that some of the things here set down as to be done, may have been already accomplished; but in such cases the knowledge of them is limited, the facts not having been made public. It is the object of this Society to evoke discussion on the subjects with which it deals, to see that nothing is concealed which may in any way tend to promote the good of all, and to record the facts and opinions thus elicited. The weekly meetings, and the *Journal of the Society of Arts*, afford the requisite facilities for effecting this, and the Council earnestly hope that the opportunities thus given may be taken advantage of.

Classes I. to IV.*—Raw Materials.

1. For an account of the Raw Materials obtainable from different parts of the world, that are not yet generally introduced into Commerce.
2. For an account of the mode of occurrence, and of the uses of Cornish, Devonshire and Dorsetshire Clays, the quantities annually worked, used in English potteries and exported.
3. For an account of the Stones used in manufacturing processes, such as Millstones, Grindstones, Hones, &c., their sources of supply, and the methods of cutting and preparing them for the market; also of the purposes to which they are applied, and of the artificial substitutes that have been introduced, and found available.
4. For an account of the different Natural Stones, whether limestones or sandstones, used for architectural purposes in the different large towns in the United Kingdom, stating the comparative durability, price, special use, and general statistics of each.
5. For an account of the materials used as Slates, Slabs, and Flags, in the principal towns in the United Kingdom, with information as to their durability, cost, chief use, and general statistics.
6. For an account of Road Material of different kinds, and the absolute and relative value of each.
7. For an account of the methods at present in use in the various coal-mining districts for ventilating and lighting the mines, with suggestions for their improvement.
8. For an account of the various commercial Copper Ores, of the smelting processes, and the methods by which the precious metals can be separated from Copper.
9. For an account of the treatment of Tin, and its application to the Arts and Manufactures, and of recent discoveries of new sources of supply.
10. For an account of the modes by which *Wolfram* can be separated from other ores; and of the uses of Tungsten in the Arts.
11. For any new application of Tungsten in the Arts.
12. For an account of Menaccanite or Iserine, and suggestions for obtaining Titanium from these ores.
13. For an account of the processes now in use for Smelting Zinc Ores, with suggestions for their improvement.
14. For an essay on the means at present in use for preserving Iron from the injurious action of water or exposure to the atmosphere: how far they are efficient as a means of preserving that material when used in connection with the Arts, in the construction of ships, or for engineering purposes.
15. For any improvement in the process of condensing the Fumes in the Smelting of Lead Slags.
16. For the best account of the production of Sulphur and Arsenic from the metalliferous ores of the United Kingdom, with statistics of the use and export of these substances.
17. For the discovery in England, or the importation from any of the British possessions, of Plumbago, or of some other substance which may be used in lieu thereof, equal in quality to that obtained from Cumberland.

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* The classification of this list is that adopted at the Great Exhibition of 1851.

18. For an account of Mineral Veins in the various Mining Districts in the British Islands, with particular reference to the differences that exist between Copper and Lead lodes, and the relations of Copper with Tin, and of Silver and Zinc with Lead.
19. For an account of the methods now in use for separating Silver from Lead Ores, with suggestions for their improvement.
20. For an account of the best proportions of metals used in the production of the compound metal Bronze, and the preparation of Bronze Washes.
21. For the invention of a White Metallic Alloy which may be successfully applied in the Arts, free from microscopic faults, hard enough for use in reflecting telescopes, and not liable to be acted upon by the atmosphere.
22. For the discovery or manufacture of a new Smokeless Fuel, which shall not occupy more space, or be of greater weight than the fuel now in use; and shall be equal in the amount of heating power, without liability to injure metals in contact with it.
23. For an account of new sources of supply of Silk Cocoons and of the best modes of packing and importing them, with a view of their being reeled in England.
24. For the production of Cyanogen by a method applicable to the fabrication of Cyanogen Compounds employed in the Arts, and better than that now adopted.
25. For the production of Ammonia or Nitric Acid from their elements, by methods which would admit of practical application.
26. For the best collection of foreign Dyeing or Colouring Substances, distinguishing those at present used from those generally unknown to Commerce.
27. For an account of the processes at present employed for the extraction of Dyes and Colouring Matters from animal, vegetable, and mineral substances.
28. For an account of the principal Dyes and Dye Stuffs at present employed in the woollen and silk trades, their sources of supply and modes of application.
29. For the production of a good and permanent Purple or Violet Dye for silk and other fabrics.
30. For an account of the principal Dyes and Dye Stuffs at present employed in the cotton trade, their sources of supply and modes of application.
31. For an account of the present means used in different countries for Dyeing Turkey Red, having special reference to the new methods for hastening the process.
32. For a means of fixing the Carmine Colour of the fruit of the Cactus Opuntia.
33. For the production from coal of Colouring or Dyeing Materials, capable of being used economically as substitutes for indigo or madder.
34. For the discovery of a practical process for converting the refuse Naphthaline of Gas Works into Alizarine or Madder red.
35. For an account of the processes employed in obtaining different products, as Paraffine, from Shale, and the uses to which they may be applied.
36. For the discovery in England of a bed or beds of pure White Sand, suited to the manufacture of Glass, and possessing similar properties to the French sands used in the same manufacture.
37. For the production of Glass by the use of the constituents of which the French sands are composed, such Glass to be of a quality equal to that produced from those sands.
38. For an economical and efficient method of producing Designs on Stained Glass for windows and ornamental purposes, by which the cost of production shall be reduced, and the use of lead frames rendered unnecessary.
39. For an account of the Chemical Manufactures of Newcastle-upon-Tyne.
40. For an account of the various materials, White Lead, White Zinc, and Carbonate of Barytes, used in the manufacture of white paint, and the advantages and disadvantages of each.
41. For an account of the economical manufacture of Oxide of Zinc, and its incorporation with colours, so as to render them not liable to be acted upon by sulphurous gases, or to fade on exposure to light and heat.
42. For the preparation of any Colour, applicable to the japanned surfaces of Papier Maché, that shall be free from the brightness (or glare) of the varnished colours now used, but yet possess the same degree of hardness and durability.
43. For the best specimen of English-made Artificial Ultramarine, together with an account of the method of manufacturing it, with suggestions for the extension of its production in this country.
44. For the production of a Prussian Blue which either on cotton or separate, shall not be attacked by soap, or moderately dilute caustic alkalies, in the cold.
45. For the preparation of light colours to be used in Enamelling or Japanning Slate or Iron, that will stand the action of heat from the fire without blistering or discoloration, and be sufficiently hard to resist scratches.
46. For an account of the processes involved in the preparation of Animal Charcoal, and its application to manufacturing and other purposes.
47. For the production of Charcoal from Wood, capable of being used as an economical and efficient substitute for animal charcoal in the manufacturing processes where the latter is at present used.
48. For the best means of Utilizing Refuse Ores, refuse Coal, and impure approximations to coal.
49. For the best means of utilizing the Clinkers produced in the furnaces of steam engines, with an account of the products obtained, and the purposes to which they may be applied.
50. For an account of the manufacture of Gas, with suggestions for increasing its purity and utilizing the refuse products of gas-works.
51. For a cheap substitute for Pitch, Tar, &c., equally impervious to air and moisture, but non-inflammable.
52. For the best collection of Tanning Substances, distinguishing those at present used from those generally unknown to Commerce.
53. For an account of the materials and methods at present employed in preparing and dressing Skins; the colours and treatments to which they are submitted in dyeing, and the machinery and processes used in embossing or producing ornamental surfaces in Leather.
54. For an account of the sources of supply of Furs, and of the methods of preparing, dressing, and dyeing them for the market.
55. For the discovery and development of any new and economical source of supply of Hair of a fine quality, suitable for manufacture.
56. For the best substitute for Horsehair, for stuffing cushions, mattresses, &c.
57. For an account of the best methods of growing and preparing Flax, with a comparison of natural and artificial modes of steeping.
58. For an account of the methods at present employed for the extraction of Oil from Seeds, and the useful application of the cake, or mare, as food, manure, &c.
59. For an account of the sources of supply and processes of manufacture of the various Lubricants employed in working machinery and rolling stock.
60. For an account of the Spices of Commerce, with suggestions in reference to new sources of supply.
61. For an account of the Drugs of Commerce, with suggestions in reference to new sources of supply.

62. For the importation from Australia, New South Wales, Van Diemen's Land, or Cape Colony, of not less than fifty pounds of Dried or Preserved Fruits, of good marketable quality.
63. For an account of the various grain and pulse crops grown in India, classifying them under their several local and botanical names, and specifying their culture, yield, uses, and prices.
64. For an account of those Palms and similar trees which yield meal, saccharine and other juices, fibres, edible fruits, &c., with a statement of the cost and commercial value of their products.
65. For the best collection of farinaceous substances imported from the Colonies, such as meal, biscuits, cassava cakes, &c., obtained from roots, seeds, or fruits.
66. For the importation of tropical fruits, such as the pine, banana, mango, &c., preserved in the form of marmalade, jam, jelly, or in combination with farinaceous substances, biscuits, &c.
67. For an account of the pressed, dried, and other preparations of Fish, forming articles of commerce in the Eastern Seas, including the Tripang, or Bêche-de-mer, Balachong, Tamarind fish, Sharks' fins, fish maws, dried shrimps, &c.
68. For an account of any useful purposes to which the Eggs and Feathers of Sea-Fowl and the Scales of Fish may be applied.
69. For the best essay on the theory and practice of fermentation, particularly as applied to the art of brewing, so as to modify, or altogether dispense with, the intermediate process of malting.
70. For a substitute for, or preparation of, Yeast or ferment for raising bread and other purposes, which may be preserved for use, better than any hitherto generally known.
71. For an account of the processes employed in the manufacture of Starch, the sources from whence it is obtained, and the purposes to which it is applied.
72. For the largest and best sample of Starch, produced from a non-edible substance, cheaper than any at present in use, and obtainable in large quantities.
73. For improvements in the processes for Preserving Animal Food, with an account of the methods at present employed.
74. For the best and most economical means of applying Carbonic Acid Gas to the preservation of Meat.
75. For the discovery and production of any new substance which can be successfully used as a substitute for Gutta Percha.
76. For an account of the best Transparent Colours, and the mode of applying them to paint Marble Statues.

(*To be continued.*)

METHYLATED SPIRIT.

(*Concluded from page* 717.)

"3. Spirit of wine is used as an ingredient for the production of ether, chloroform, sweet spirit of nitre, and fulminating mercury. These are important articles of manufacture, the first three articles being valuable medicinal agents, and the last-named being used for making percussion caps for fire-arms. Ether and chloroform are also made use of on account of their solvent power, especially the former. Sweet spirit of nitre is used exclusively in medicine, but being a popular remedy the quantity used is very considerable. We may state with reference to this article, that it is made by distilling a mixture of spirit of wine and nitric acid, and that when properly prepared it consists of a solution of a small quantity of nitrous ether in spirit of wine. The proportion of nitrous ether present is extremely variable, and in some commercial samples is so small as merely to impart a slight flavour to the spirit; which flavour, moreover, is by no means disagreeable. From information derived from those practically acquainted with the commerce of this article, it may be inferred that a large proportion of the sweet spirit of nitre now used is made from illicit spirit, the price at which the wholesale dealer can purchase sweet spirit of nitre being less than that at which it can be produced with spirit on which the duty has been paid. It is scarcely to be expected that spirit which has been rendered permanently unpotable can be used for making sweet spirit of nitre, as the peculiar and unobjectionable flavour of that compound is the popular test of its good quality. When made with the methylated spirit, the compound acquires a disagreeable flavour, which is more especially developed on diluting it with water; and it is impossible to recover the alcohol again in a pure state from such sweet spirit of nitre. On the other hand, the separation of pure alcohol from good potable sweet spirit of nitre, such as the public are accustomed to use and require, is attended with no difficulty. It appears improbable, therefore, that any regulations could be devised for the preparation of sweet spirit of nitre from duty-free spirit, which could be adopted with safety to the revenue.

"Ether and chloroform may be made with the methylated spirit, and when the products have been purified in the usual way, they do not appear, upon a superficial examination, to differ from those made with pure spirit. Upon allowing them slowly to evaporate, however, a peculiar and disagreeable odour becomes perceptible, towards the end of the evaporation. This impurity would probably preclude their application for most medicinal purposes, for which they are required to be pure, or at least to be free from any foreign flavour either in taste or smell. When used as solvents, the same degree of purity is not generally essential, and we believe that ether and chloroform produced from the mixed spirit are perfectly applicable for most manufacturing purposes.

"Fulminating mercury is produced from mercury, nitric acid, and alcohol, and in consequence of the large quantity of alcohol consumed in the process the price of the product is greatly influenced by the cost of this ingredient, so that the English manufacturer has found it difficult to compete with those who can command cheap spirit. We are informed that most of the fulminating mercury now used in this country is either made from illicit spirit, or is brought from the Channel Islands, where the low price of spirit offers an advantage to the manufacturer. The methylated spirit is applicable for this manufacture.

"We have been aided in this part of our inquiry by the information kindly offered to us by Mr. Alfred White, Mr. Charles Davy, and Mr. F. Joyce.

"4. A considerable quantity of spirit of wine is sold by retail dealers, chiefly chemists and druggists, for burning in lamps as a source of heat, including its application for singeing horses. It is also mixed with oil of turpentine or other hydrocarbons for burning in lamps as a source of light. The methylated spirit is quite suitable for such applications.

"5. Spirit of wine is used as a solvent and menstruum for administering the active constituents of animal and vegetable substances used in medicine in the form of tincture, spirit, &c. These preparations being intended for the treatment of disease, and their efficacy frequently depending upon the association of substances which from long experience have been found to contribute to the required result, the unauthorised introduction into their composition of a new substance, and especially one of so marked a character as methylic spirit, cannot in any way be sanctioned. There is a large number of pharmaceutical preparations of the sort here referred to, most of which are made according to formulæ given in the Pharmacopœias, a strict compliance with which is enjoined upon those who compound them. We cannot recommend the substitution of any mixture for the pure spirit directed to be used in making these preparations.

"6. Spirit of wine is employed as a solvent of essential oils and other odorous substances used in perfumery, and it is scarcely necessary to say that the addition of anything to the spirit imparting to it an unpleasant odour must render it unfit for purposes of that description. The methylated spirit, therefore, cannot be used for the preparation of perfumes.

"7. The employment of spirit of wine in the manufacture of acetic acid by the German process of oxidation has been suggested as a possible result of the entire removal of the duty on pure spirit; but this application could not obviously be made of a mixed spirit, such as has been contemplated in this inquiry.

"8. The methylated spirit would serve for the preservation of objects of natural history, and also for the purposes generally to which alcohol is applied in chemical research. It would remove an impediment to the prosecution of science in this country, created by the high price of alcohol, which has long been complained of."

A letter was subsequently addressed to Messrs. Graham, Hofmann, and Redwood, by Mr. John Wood, Chairman of the Board of Inland Revenue, in which he draws attention to a passage in the Report, which states that, as the oils in crude naphtha are removeable from the mixed spirit by a process not very difficult, the question is reduced to the applicability of pure wood-naphtha for the object in view.

Mr. Wood says:—"I am not entirely convinced that the question is thus narrowed. We have two objects: first, to prevent the recovery of spirit of wine from the mixture in such a state of purity as to render it potable; and second, to render the mixed spirit so offensive as to prevent any temptation to its use among the workpeople, who will necessarily have access to it in the manufacturing processes in which it will be employed.

"Now it is obvious that the use of crude naphtha produces a more offensive mixture than that of the pure naphtha; and that it would probably be so offensive as to preclude its consumption by workpeople; and this would be an important point gained.

"It is also obvious that any attempt to render it potable (as an article of commerce) would be more troublesome and expensive.

"The question, then, remains, whether the crude mixture would be generally available in arts and manufactures."

This letter elicited the following reply:—

"London, 8th January, 1855.

"Sir,—The observations which we desired to add to our 'Report on the Supply of Spirit of Wine, free from Duty, for use in the Arts and Manufactures,' have reference to the mode in which the public is to be supplied with the spirit. On a review of the subject, and after further inquiry among manufacturers and others, we doubt whether it would be prudent to permit, at first, the retail sale of the methylated spirit. It has been represented to us that the unrestricted sale of the spirit would cause it to get into the hands of individuals of perverted tastes, who, in extreme cases, may use it for producing intoxication. Although we are satisfied that such a misapplication of the methylated spirit could only occur in some isolated instances among persons of confirmed habits of intemperance, yet it may be feared that even such cases would cause a public outcry against the measure before it had received a fair trial. We would, therefore, recommend that the methylated spirit should be issued, by agents duly authorised by the Board of Inland Revenue, to none but manufacturers, who should themselves consume it, and that application should always be made for it according to a recognised form, in which, besides the quantity wanted, the applicant should state the use to which it is to be applied, and undertake that it should be applied for that purpose only. The manufacturer might be permitted to retail varnishes and other products containing the methylated spirit, but not the methylated spirit itself in an unaltered state.

"In thus suggesting a restriction upon the sale of the methylated spirit, we must, however, express our belief that this limitation may be eventually removed with safety, when the measure has been fairly and fully introduced.

"Our attention having been directed by your letter of the 2nd November, 1854, to that part of our Report in which we recommend the use of purified wood-naphtha, rather than crude naphtha, for preparing the methylated spirit, we have instituted new inquiries on this part of the subject.

"We have, in the first place, to state that the distinction of crude and purified wood-naphtha is not generally recognised in commerce. The term 'crude wood-naphtha,' when used, is understood to designate a very impure sort of naphtha, not in the state in which that substance is first produced, but in a partially, although very imperfectly purified state. This product, which is of a brown colour, and contains tarry matter and oils which are not easily volatilised, after being further purified, constitutes the wood-naphtha generally met with in commerce, and which we have referred to as purified wood-naphtha. The terms 'crude' and 'purified,' as thus applied, have not any definite signification; they are used to indicate an undefinable difference of purity, the principal feature of which consists in the presence of more difficultly volatilised matter in the less pure than in the more highly purified article.

"We have further to state, that the purification of crude naphtha, to the extent to which this is effected for commercial purposes, is not attended with any difficulty. Methylated spirit prepared with crude naphtha, may also be rendered as free from taste and smell as that made with purified wood-naphtha, by simple and inexpensive means. We have had a methylated spirit prepared containing 10 per cent. of the crudest wood-naphtha we could procure, and which was quite unsaleable. Now, by a simple distillation from 10 per cent. of potash, this is highly purified, so as to be quite equal, if not superior, to the methylated spirit made with Turnbull's purified wood-naphtha, as recommended in the Report. The cost of applying this purification of methylated spirit would be less than 1s. a gallon.

"We believe that if very impure wood-naphtha be used for making the methylated spirit, the spirit so prepared will not fulfil the requirements of any class of manufacturers referred to in our Report, unless the purification of the spirit before its use be permitted, and such, we presume, would not be deemed advisable; if this purification was forbidden, the honest manufacturer would obey the law, and work to a great disadvantage as compared with his less scrupulous competitors, who would resort to illicit purification. This of itself would be a great evil, and one, we fear, quite beyond the powers of the Excise to prevent. We admit that the methylated spirit made with crude naphtha would be more unpalatable than that made with purified wood-naphtha, and that the latter would be more likely than the former to be drunk by the workmen employed in manufactories where such spirit was used; but, as already stated, we can only conceive it possible that such use would be made of methylated spirit by individuals of perverted taste, and confirmed habits of intemperance; and in such instances we doubt if even the use of crude wood-naphtha would be sufficient entirely to prevent the evil.

"The conclusions we have come to, as the result of our investigations on this subject, are, that methylated spirit made with a very impure wood-naphtha could not be advantageously used as a solvent for resins by hatters and varnish-makers, as the less volatile parts of the naphtha would be retained by the resins after the spirit had evaporated, and the quality of the resins would be thus impaired, and that such methylated spirit would be almost wholly inapplicable for chemical and pharmaceutical purposes, and for the preservation of objects of natural history. The benefits anticipated from the proposed measure would thus be greatly limited, without, as we believe, any adequate advantage resulting, either in increased security to the revenue, or otherwise.

"It is purified wood-naphtha, and not the impurity which crude naphtha contains, that presents the great and insuperable difficulty we have indicated to its separation from spirit of wine with which it has been mixed; in fact, the more highly purified the naphtha is with which the spirit is mixed, the more difficult will it be to effect an alteration of this mixture, in the way contemplated by any chemical process; and in proportion as this condition is fulfilled, the mixed spirit will be more valuable for use in the arts and manufactures as a substitute for spirit of wine; on the other hand, the impurity which constitutes the difference between crude and purified wood-naphtha presents little or no difficulty in the way of its separation, whilst for all the purposes referred to it renders the mixed spirit contained in it less applicable, and for some of those purposes it entirely precludes its application.

"We are, therefore, unable to recommend any alteration in the mode of preparing the methylated spirit suggested in our Report.

"THOMAS GRAHAM.
"A. W. HOFMANN.
"T. REDWOOD.

"To John Wood, Esq.,
"Chairman of the Board of Inland Revenue."

The following extracts from letters written by gentlemen engaged in various branches of manufacture and scientific research, will serve to show the advantages already derived from the use of the methylated spirit.

Mr. F. A. Abel, director of the chemical establishment of the war department, says:—

"The measure no sooner came into operation than my recommendation to substitute methylated spirit for alcohol and wood-naphtha in all branches of manufacture of war-material in which these articles were employed, was adopted, and, independently of the considerable saving resulting from this step, I may cite the following examples of the benefits derived therefrom.

"In the extensive use of alcohol, in the laboratory department, for moistening explosive compositions which are subject to considerable pressure or blows, it was impossible to prevent the workmen, into whose hands the alcohol was necessarily placed, from partaking of it to a very serious extent. All methods legitimately applicable with the view to check this practice were of no avail; even the mixture of the spirits with a small quantity of meal gunpowder did not prevent many workmen from indulging freely their propensity for alcohol. Since the introduction of methylated spirit there have been only very few instances of individuals who have ventured to partake of a small quantity of the spirit. It may also be mentioned that these men were immediately detected by the foremen, in consequence of the peculiar odour imparted to the breath by the methylated spirit; while formerly, although the illegitimate consumption of alcohol was very general among the men employed on that particular work, it was possible to detect only the most flagrant cases."

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"As an instance of the advantage with which methylated spirit may be substituted for alcohol in chemical processes, I may mention that no difficulty has been experienced in effecting such a substitution in the preparation of fulminate of mercury, and that we have in consequence been enabled to procure this substance, of which we employ large quantities, at a very important reduction in price."

"Mr. Frederick Joyce, of Waltham Abbey, manufacturer of anti-corrosive percussion caps and chemically prepared gun-wadding, in speaking of the spirit, says:—

"It answers well for making varnish, the methyl in such case not interfering, and I make no doubt shortly of rendering it equally available in the formation of fulminate of mercury and nitric ether, the only processes to which it is applied by me."

Messrs. Thomas De La Rue and Co. of Bunhill-row, write:—

"The privilege of using methylated spirit has been of material benefit to us in the manufacture of our goods, and we are continually extending its employment."

Messrs. Thomas Devereux and Son, of Eldon-street, Finsbury, French polishers, write:—

"The free introduction of the methylated spirit has proved of great advantage, but at the same time, we would respectfully suggest that whilst the admixture of *one ounce* instead of *three* of gum, to the gallon of spirit, would equally protect the revenue from fraud, it would be much more applicable to the purposes of our trade, so large a portion of gum rendering it unfit for the finer descriptions of work in finishing, and in varnishes."

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"The condition of the workmen has been much improved by the advanced rate of wages that employers have been enabled to make through the reduced cost of material."

Messrs. J. T. and E. Christy and Co., of Gracechurch-street, hat manufacturers, write:—

"The methylated spirit which has entered our manufactory has been applied to the purpose of waterproof stiffening for hats. Varnishes, which also contain spirit, are prepared upon our premises, and not now purchased from varnish makers.

"So far as we are able to come to an opinion from the limited period the privilege has been available, it has been beneficial to the manufacture of hats."

Mr. George Hutchinson, of Glasgow, writes:—

"The use to which methylated spirit was applied by me, was primarily the manufacture of *oleic ether*, for the purpose of making a *lubricant* suitable for *fine machinery*, and incidentally the manufacture of sulphuric ether, which is used in medicine and photography.

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"It will be found of *national importance*, as being an efficient substitute for *sperm oil*, which is *getting scarcer year by year*."

Mr. Alexander Christie, of Southwark-bridge-road, who has been for many years extensively engaged in the naphtha and spirit of wine trades, says:—

"I have had ample means of knowing the baneful effects produced by the use of naphtha on the working classes, who were compelled to use it instead of spirits of wine.

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"The measure is of the highest importance to the manufacturing industry of the country, and a boon to the working classes engaged therein; and in order to more than double the present consumption, it is only necessary to alter the present standard of the naphtha used, and, if possible, to dispense with the bond, which is a great obstacle to its unlimited use by the smaller class of consumers.

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"The recent permission to use methylated spirit for the manufacture of nitre, and the low price at which it can be sold, viz., 4s. 6d. to 5s. per gal., has completely upset the illicit trade. I may mention that, of my own knowledge, I could name four individuals whose united consumption of illicit spirit did not, for years, amount to less than 500 to 600 gallons weekly, and who now do not use a gallon, but are considerable consumers of methylated spirit.

"I understand that methylated spirit is being used in a large brewery, not only in cleaning the machinery from the spent oil and grease, but in coating their vats and casks with a solution of shellac, on which the beer has no action, and by which must and absorption is entirely prevented.

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"Among those who have applied to me, and who would have been considerable consumers could they have obtained it in a pure state, without the addition of gums, and without giving bond, to which there is the greatest objection from all classes of consumers, I would mention house-decorators, gold-beaters, dyers, veterinary surgeons, philosophical instrument-makers, photographers, and also for general domestic purposes, to all of whom your regulations, as to bond, are a great barrier to its use."

Messrs. S. R. and A. White, of Castle-street, Saffron-hill, write:—

"The use of duty-free spirit has already been very beneficial to our branch of manufacture. It has enabled us to supply sulphuric ether at such a price that its use in the arts has been increased by a quantity represented by about 2,000 gallons of of spirit, while in the first six weeks after we were permitted to use it in the manufacture of sweet spirit of nitre, 600 gallons were used in the production of that article, the greater part of which 600 gallons, if not the whole, has taken the place of what was generally produced from illicit spirit; and these results have been obtained without diminishing the duty paid on spirits of wine, as we still use pure spirit as largely as formerly."

Messrs. J. F. Macfarlan and Co., of Edinburgh, write:—

"We have found the methylated spirit useful, firstly, in the preparation of spirit varnishes; these include French polish and furniture varnish; both of these are employed by cabinet makers in beautifying furniture, and are used in very considerable quantity; they include also lacquers, which are very various, and are employed by brass founders, gas fitters, &c.

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"Secondly. In the preparation of choloform.—At first it was regarded as extremely improbable that we should succeed in preparing this article fit for use in medicine, from the methylated spirit. I am, however, happy to say that we have been able to prepare it as free from flavour, as high in density, and as pure in every respect as that from spirit of wine, so that no difference can be traced between them; and that from methylated spirit has been employed as freely and with as much advantage as the other in surgical operations in the public theatre of the Royal Infirmary and in private.

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"In England, however, the prejudice against the methyl has not as yet been overcome; and hence the employment of the chloroform from it is only to a limited extent, but I feel satisfied that it will ultimately prevail.

"Thirdly. In the preparation of ethers.—The sulphuric ether is a mixed fluid with a boiling point directly in proportion to the quantity of methyl in the spirit. It has been found, however, equally safe as a medicine, and in the extraction of alkaloids by solution answers equally well with the other. We have employed it also with the preparation of tannin, of fine quality, and are thus enabled to compete with the foreign manufacturer. We have also prepared a good deal of it for photographers. In this beautiful art it now seems to answer as well as that from spirit of wine, though some still retain an affection for that from pure spirit of wine, believing it to be superior. I am inclined to think, however, that the cheaper will in the end supersede the dearer. In the preparation of nitrous ether we were long delayed by unexpected difficulties, which have been overcome, and we have now prepared it of the proper ethereal flavour, and of good quality, so as to be available in medicine."

With reference to its applicability for scientific purposes, or as an antiseptic for use in museums, the following testimony will not be uninteresting.

Prof. Goodsir, of the University of Edinburgh, says:—

"It will be some time before we can speak with confidence as to the applicability of the methylated spirit to museum preparations.

"It has proved, however, most useful for general anatomical purposes, and has enabled us to work much more comfortably than hitherto."

Dr. Stevenson Macadam, also of Edinburgh, says:—

"I have found the methylated spirit of great value in analytical research, and, from its comparative cheapness, I have been enabled to prosecute inquiries in organic chemistry, which I could not have undertaken had I been compelled to purchase pure ethylic alcohol."

Dr. W. E. Page, of St. George's Hospital, and Prof. Quekett, of the College of Surgeons, found the spirit answer for preserving anatomical preparations, though in some cases a deposit took place, which they consider objectionable. This appears to have been only an accidental impurity in the samples furnished to these gentlemen.

Prof. W. Sharpey, of University College, writes:—

"We have been using the methylated spirit for some time past in preparing and in permanently preserving specimens in the anatomical museum, and so far as our experience goes, the mixed spirit seems generally to answer these purposes as well as pure spirit of wine."

Dr. John Struthers, of the Medical School at Edinburgh, states:—

"1. That the late increase of duty in Scotland would have driven us almost to abandon the use of spirit for anatomical and pathological purposes.

"2. That the methylated spirit has been used in preference to all other preservative agents in the museum of the Royal College of Surgeons, and in the museums of the various teachers of medicine."

Professor Williamson, of University College, says:—

"The Excise duty on spirits of wine used for scientific purposes, was in truth a tax on organic chemistry; for the greater number of researches in that department of science involve the use of alcohol or some of its derivatives; and its removal by the introduction of 'Methylated Spirits' for such purposes, has already been productive of considerable benefit.

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"In illustration of the extensive influence of this cheapening of alcohol for useful purposes, I may mention that collodion, one of the chief materials of the photographer, is now prepared from ether made from methylated spirits, and sold at a far lower price than formerly.

Professor George Wilson, Director of the Industrial Museum of Scotland, at Edinburgh, writes:—

"Methylated spirit is employed, so far as I have learned, chiefly by two classes of scientific persons, viz., analytical chemists, and naturalists, including among the latter those medical professors and lecturers who have occasion to preserve the bodies of animals or parts of them, in antiseptic liquids.

"Chemists employ it in the same way as they formerly did pure alcohol or spirits of wine: (1) As a smokeless, cleanly fuel for their spirit lamps. (2) As a solvent of vegetable and animal substances, which water and the more familiar chemical reagents will not dissolve: and (3) as a means of testing or recognising bodies in the course of analysis.

"For the first of these purposes methylated spirit is equal to pure spirit of the same strength.

"For the second, it is nearly equal to pure spirit, measure for measure, and as its slight inferiority is more than compensated by its cheapness, it can be used in larger volume, so as to excel wine-alcohol in value as a solvent. The modified sulphuric ether made from methylated spirit has a similar value for analytical chemical purposes, and the chemistry of plants and animals (organic chemistry), which hitherto has been comparatively neglected in this country, as compared with the continent, owing to the cost of alcohol and ether, will now be much more largely prosecuted by British chemists than before.

"For some analytical purposes methylated spirit cannot be substituted for spirits of wine; but these are few, and consume so little alcohol that this defect is of comparatively small importance. I can assure you, accordingly, that so far as scientific chemistry is concerned. the methylated spirit is highly prized by all who are engaged in the research, and from personal knowledge I can testify that it is in constant use in the analytical laboratories of Edinburgh and Glasgow."

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"To naturalists and medical lecturers, methylated spirit is of still more value than to chemists.

"Thus it is impossible to dissect satisfactorily certain organs of the body, unless they are previously hardened in spirit, but the cost of this has hitherto greatly limited its use in our anatomical rooms, much to the disadvantage and discomfort of the student. To him, accordingly, the introduction of the methylated spirit is a great boon."

TONNAGE REGISTRATION.

The following letter, addressed to the editor of the *Mechanics' Magazine*, has been received from Mr. Atherton, in reply to the article which appeared in the last number but one of the *Journal*:—

Sir,—Referring to your editorial article in the *Mechanics' Magazine* of the 20th inst., No. 1,728, and which also appeared in the *Society of Arts Journal* of the 19th inst., No. 200, I am reluctant to renew our discussion on the Tonnage Question, because really, so far as I can gather from your past and present reviews of my papers, we are perfectly of one accord on the subject matter involved in our discussion, namely, the desirableness in a public point of view of rendering our statistics of Shipping Registration more complete than they now are, under the Merchant Shipping Act of "1854." The object with which, from the first, I have availed myself of the facilities so liberally afforded by the Society of Arts, by the *Mechanics' Magazine*, and by the British Association, for bringing questions of this character before the notice of the public, has been to elicit thorough investigation into the merits of the question, and obtain a demonstration of public opinion thereon through some channel having recognised claims for being regarded as an exponent of the sentiments of that section of the public who interest themselves in scientific questions of this character, for without such an expression of public opinion a case would not be satisfactorily established on which the revision of an Act of Parliament could be reasonably entertained. This, my object, has been fully attained, for, in addition to the mark of approbation awarded to me at the Society of Arts (the Society's medal), and the fact of the British Association having referred my papers to committees of the mechanical and statistical sections, the articles which have appeared in the *Mechanics' Magazine*, not merely as the contributions of a correspondent, but expressly put forward as editorial reviews, are surely entitled to the deference which attaches to the expression of opinion by the literary exponent of an influential, and, in this matter, a peculiarly qualified section of the public; and when it is further considered that this authoritative declaration of opinions is put forward and advertised as a comprehensive review of the Tonnage Question, it is, I beg to assure you, with the greatest satisfaction that I forego any petty points of difference of opinion that may exist between us as to any suggestions which I have made with a view of remedying the deficiencies of our present system of Shipping Registration. I am proud to regard myself as acting in cooperation with the editor of the *Mechanics' Magazine*, as the organ of the section of the public before adverted to, claiming the revision of the Merchant Shipping Act of "1854," as respects the admeasurement for tonnage and the registration of shipping, on grounds so forcibly expressed and so spontaneously advanced in the editorial articles of the *Mechanics' Magazine*, in the following terms:—

1st. Because "the tonnage measurement and registration of vessels has never been brought before Government in any other than a purely fiscal point of view."

2nd. Because "Government, in legislating on tonnage registration, has not contemplated the scientific features of the case, nor those which bear on the sea voyage."

3rd. Because "undoubtedly there is a point beyond which ships cannot be safely loaded."

4th. Because "undoubtedly it would be desirable, if possible, to fix a limit to the degree to which ships may be loaded."

5th. Because "as regards the draught of water at which ships leave port, let the Board of Trade have, if it so please, properly authorised officers to note and record the facts."

6th. Because "we should see with satisfaction a competent Committee appointed by Government, or by the British Association, with a view of ultimately, if need be, acting on the Government, to take into consideration the foregoing points."

7th. Because "some definite displacement of a vessel involving the settlement of the whole weight, when fully equipped for sea, being a necessary datum for any scientific inquiry, it may be worthy of consideration whether the constructor of every vessel may not be required to furnish to the Board of Trade, for the purpose of registration, what he designs to be the vessel's load displacement."

8th. Because "in vessels of war the constructor always fixes and calculates the load displacement, and there seems no reason why this course should not be pursued with regard to merchant ships."

9th. Because "we do not anticipate any great repugnance on the part of shipbuilders and shipowners to register what may be taken as the mean fair load of the ship."

10th. Because "a knowledge of the weight of cargo designed to be carried by each ship, being the difference of the constructor's load and light displacement, would (if it should please the Legislature to require such registration) supply all the information that could be fairly required for statistical purposes."

11th. Because "the nominal horse-power of a marine engine gives no indication whatever of the real power to which it can work; for, while some marine engines work up to twice, some will work up to four times, the nominal power."

12th. Because "to test the value of a vessel propelled by steam in a mercantile point of view, we require to know the weight propelled and the power actually exerted in propelling it, and also the speed at which it is moved."

13th. Because "in a scientific point of view, a more correct mode of estimating horse-power is required."

14th. Because "every fresh vessel of improved form and steam-power application tends to lower freights, so as to give the public a good share of the advantages resulting from the adoption of good types of build and efficient adaptation of steam-power, so as in a moderate number of years materially to lower the average freight charge for every ship."

15th. Because "it must be admitted that there are such deficiencies in the registration of tonnage and horse-power as to render all scientific inferences drawn from those data valueless."

16th. Because "what is required is that the registered horse-power should really represent the effective horse-power."

There is just one other point, the exposition of which will doubtless meet with the concurrence of the editor of the *Mechanics' Magazine*. I therefore take the liberty of noticing the following tonnage anomaly, as an additional ground on which to demand Tonnage Registration reform, namely,—

17th. Because, under the present system of tonnage admeasurement and registration, it appears that five ships, the property of one Company, are advertised (see *Times*, Sept. 20, 1856) as being collectively 15,000 tons burthen, whilst their registered tonnage, at which these same ships are rated for certain fiscal dues, is only 7,488 tons.

Such being the comprehensive terms in which the editor of the *Mechanics' Magazine*, in his editorial articles, has acknowledged the deficiencies of our present system of tonnage admeasurement and shipping and engine-power registration, thus confirming in each of these particulars the statements which I have advanced in my papers, I see no occasion to disturb the harmony of our joint agitation with a view to the amendment of the law in regard to the fundamental deficiencies above set forth, by raising any question on the differences of opinion that may exist between us as to the mode of correcting these deficiencies; for, on this point also, namely, the amendment of the law, I concur with the editor of the *Mechanics' Magazine* in paying deference to the decision that may be arrived at by the committee appointed by the British Association to consider these matters, the committee embracing among its members, as is acknowledged by the editor of the *Mechanics' Magazine*, "gentlemen some of them eminent for scientific ability, and others for skill as practical builders, which holds out a prospect of impartiality in the conduct of its deliberations." In the hands of such a committee the shipping interests will surely have no occasion to apprehend unreasonable interference, nor to proclaim the wail "*Timeo Danaos et dona ferentes*," which the editor of the *Mechanics' Magazine* has been pleased to ascribe to them.

I am, &c.,

CHARLES ATHERTON.

To the Editor of the *Mechanics' Magazine*.

MARINE CEMENTS.

The following is an abstract of a paper on "The Materials employed in Marine Works," presented to the French Academy of Sciences by M. Chatoney, engineer of the Ponts-et-Chaussées, and M. Rivot, mining engineer. A favourable report upon it has been made by a committee, consisting of the following gentlemen:—MM. Chevreul, Poncelet, Dufrénoy, and Marshal Vaillant.

Argillaceous or siliceous limestone requires much pulverising before being subjected to the heat of the kilns, in order to produce a good quality of hydraulic lime or cement. A thoroughly compact texture, and a sufficient quantity of carbonate of lime at the surface, to protect it against the action of the sea-water, are necessary conditions of stability; but the best chemical composition of the materials can only be determined practically by experiments made almost on the very spot where the works are to be constructed.

Excellent siliceons hydraulic lime may be artifically obtained by submitting to a moderate heat a mixture of 70 to 80 parts of pure limestone, and 20 to 25 parts of fine sand or flint; a definite silicate of lime ($\mathrm{Si.\,O^3 + 3\,Ca.\,O.}$) which in forming a hydrate takes up six atoms of water. The more intimate the previous mixture of the materials the better.

The argillaceous hydraulic lime produced by burning either natural or artificial mixtures of limestone and clay, is not found to be so well adapted for use. The proportion of 20 to 22 parts of clay to 80 parts of limestone is found, upon the whole, to be the best. When the product contains too large a quantity of free lime, it is found advisable to use rather a clayey sand in mixing the mortar; this renders it more binding, and gives it greater power of resisting the action of sea-water. Too much clay would be very injurious, so that great care should be taken, and special experiments made, wherever this latter plan is adopted.

Cements which set quickly, and are prepared under moderate heat, are always difficult to manage in marine works, as they contain no free lime, and, consequently, their hardness is all that preserves them from the influence of the sea-water. They may, however, be improved by adding a certain proportion of lime, and letting the mixture stand a considerable time.

Natural or artificial cements well burnt, and containing only a small portion of quicklime, such as those of Parker, the Medina, or the Portland, owe the great solidity which they acquire under water almost entirely to the presence of the hydrosilicate, as $\mathrm{Si.\,O^3 + Ca.\,O. + H.\,O.}$ contains less water by half than the corresponding silicate produced in the hydraulic lime or cement, which is burnt at a lower temperature. These are found to answer best for works which are constantly immersed. They would probably not answer so well for those which are exposed on each side to the effects of water at varying heights.

Artificial pozzolana but seldom gives good results. With natural pozzolana fat lime should be used in preference to hydraulic lime, and it is most important to submit the mixture previously to a long soaking in a small quantity of water. This plan is adopted by the Dutch engineers, and tends to account for their remarkable success.

Sea-water differs much from fresh-water in its effect on different kinds of mortar and cement, not only from the constant and often violent action of the tide and waves, but from the various salts, carbonic and frequently hydrosulphuric acid held in solution.

Sea-salt generally retards the setting of mortar and cement; the salts of magnesia exert but little action on free lime, or on the aluminate of lime.

The proportions of carbonic and hydrosulphuric acid vary much in different localities; they exert an action from the first moment of immersion until complete decomposition is effected, or at least till the cement becomes solid and impenetrable. They act first upon the free lime, and then upon the aluminate.

It has been noticed that where shells are very abundant, submarine works become covered with a sort of calcareous coating, which effectually protects them against all further action, and this protective influence of the marine animals may be best imitated by adding to the mortar or cement employed, free lime, in a proportion which must be determined experimentally for each locality.

Particular stress is laid on the following qualities, as essential to the formation of good hydraulic mortar:—

It is essential that the materials should be thoroughly pulverized before mixing, so that the combination may be as perfect as possible.

Sufficient free lime must be present to allow the carbonic acid in the water to combine with it, and form a protective coating of carbonate.

A long soaking of the materials is advisable, in order that the chemical combinations necessary for the ultimate stability of the mortar may take place before it is actually used.

Colonial Correspondence.

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COLONIAL LABOUR.

25, Bernard-street, Russell-square, Sept. 22nd, 1856.

Sir,—Colonial labour is a problem not easy of solution, but if we wish to make available the various resources of our numerous colonial possessions, it is one which must be solved. Happily we have to deal with free labour. In time we stepped forward—we have always been first in the march of freedom—to liberate the slave, and thus escaped that fiery vengeance which overtook and annihilated the proprietors of human flesh in St. Domingo, which threatens Cuba, and which now hangs like a thick cloud over the Southern states of America, where the struggle in Kansas foreshadows, not the extension of slavery, but its death. Viewing with unmixed disgust the philo-slavery effusions contained in some recent silly female productions, and not accepting, without a liberal allotment of salt, the amusing and exciting extravaganzas of the amiable and ingenious Mrs. Stowe, I think, that of all the curses inflicted upon fallen man, slavery has been the most bitter and enduring in its effects. It has been equally a curse to the slave and to the master. The former has been degraded, the latter demoralised. The one has lost individuality and self-appreciation; in the other the heart has been depraved, and the best feelings of our common nature have been stifled. Happily, as I said before, we have got rid of the accursed thing, and we have now to deal with men as free to act as ourselves, and we must proceed upon the principle of mutual benefit and reciprocal dependence, a principle possessing more astringency between the employer and the employed, than the relationship of the master and the slave. But admitting all this, where are free labourers to be obtained? It is undoubtedly the fact that, in the greater part of our West India colonies, there is a scarcity of suitable labour. This dearth has been produced by several causes. First, there can be no question that the tone of mind which ensued when the shackles of bondage were struck off did for a long time, and does now to a very considerable extent, render extremely difficult the employment of labourers in the colonies. The bow, when released from its tension, assumes a curve in the opposite direction. In like manner was it with the mind of the negro. When he was a slave he was compelled to work against his will; when he became a free man it was his special enjoyment—it was the clear and unmistakeable assertion of his rights—not to work at all. He could not persuade himself that he had ceased to be a slave if he did not luxuriate in complete inaction. His physical wants were few and easily supplied, but repose was his supreme felicity; this he revelled in. It was to him meat and drink and gorgeous apparel. It was everything. Nothing was further from his thoughts than work. It smelt of the chain—it savoured of the lash. This feeling is not so strong among the negro population now as it was several years ago, but it certainly still exists. It is this feeling which stimulates the negro to demand so exorbitant a remuneration for his services, and makes him unwilling to perform the most trifling act without a fee.

Another cause of the scarcity of negro labour in our colonies may be traced to the acts of the employers themselves subsequent to emancipation. Whilst sugar, and rum, and coffee were realizing immense profits to the producers, the West India planters, like the merchants of Tyre, were princes—they rioted in excess—they wallowed in profusion. Purple and fine linen were their apparel; cedar of Lebanon, and gold from Ophir, composed their dwellings. But they saw not, or cared not, for the future. The cloud upon the horizon, but yet the size of a man's hand, was undiscerned by them; therefore, when the struggle came, their loins were not girded, when darkness overspread the land, their lamps were not burning. Then came distress, and bankruptcy, and ruin. But when the battle, even at the last moment almost, might have been retrieved by courage and resolution, instead of seizing a fresh sword and a new spear, and rushing into the conflict, they fell upon each other's necks, like the chorus in a Greek tragedy, and, weeping over their fallen fortunes, gave utterance to plaintive cries. As a last resource, and to keep their heads above water from day to day, they disposed of their lands, bit by bit, in small allotments, to those very negroes, now standing erect before them, with liberty written in every lineament of their swarthy features, who formerly had spoken with "bated breath," and crouched and shrunk with naked back from the biting cat. They thus raised the negro population, who would have become in due time a useful labouring class, to be the lords of the soil. This act of infatuation sealed their doom. What negro could be induced to labour for another who had an acre or two of land to cultivate for himself. Henceforth he himself would have a stake in the country. He was free—aye, as free as the white man, his former lord. He would not labour as a serf—why should he? That time had passed, But he would be the founder of a family, and transmit to his free descendants the paternal estate. In this way many reasoned, and although we cannot admit the correctness of their logic, it is impossible not to appreciate the new-born self-esteem which dictated such sentiments.

There is another cause now at work, which is striking at the very roots of the labouring classes in the colonies. Every one must acknowledge the necessity of a sound secular, moral and religious education for the poor. It is the lever with which we hope to elevate them above vicious tastes and degrading propensities,—it is the instrument with which we seek to make them useful and intelligent members of society and good Christians. But the education, to contribute to these desirable ends, must be practical. It must be an education which will be really of use to them in the station in which Providence has placed them. But in some of our colonies a system of tuition has been adopted in their free schools, by extremely worthy, well-meaning, but, in my humble opinion, mistaken persons, very ill calculated for those who are designed to profit by it. The children, male and female, of the negro population, are taught, or attempted to be taught, a knowledge of things which can never in the slightest degree, if remembered, benefit them in after life, but which is certain to puff them up with vanity and conceit, and dispose them to think that they are fitted for higher destinies than that of manual labour. I would not have it supposed that I would encourage any obstruction in the way of intellectual advancement. On the contrary, I would remove every impediment. I would teach the children of the poor to read, write, and draw well,—they should learn arithmetic, and they should be thoroughly imbued with sound principles of religion and morality. I would also have them instructed in mechanics and the industrial arts. I would instil into their minds general ideas of navigation, husbandry, ironfounding, tanning, currying, bread-baking, building, carpentry, shoemaking, &c. They should be taught to manage the tiller, to guide the plough, to wield the hammer, impel the shuttle, and direct the saw. A knowledge of such things would be of infinitely more use to them than a superficial acquaintance with metaphysics and logic, history and astronomy, composition and poetry, Latin and Greek, the niceties of grammar, and the subtleties of style. To the labouring mechanic, to the child of toil, who must win his way by the sweat of his brow, what avails the rise and fall of empires long since departed? Why should he trouble his head about Cyrus, or Alexander, Cæsar, or Charlemagne? What need he care for Hengist or Vortigern, William or Harold?

> "What's Hecuba to him or he to Hecuba
> That he should weep for her?"

His business is with the present, not with the past—with facts, not with ideas. It has been said that a *little* learning is a dangerous thing. So it is; but not so a little knowledge. The former generates humours and conceits—the latter increases the appetite whilst it feeds it. The former causes a man to run from one to another, like the "Bourgeois Gentilhomme" of Molière, babbling about nouns and pronouns—the latter leads to the invention of the telescope and the steam-engine. Possessing the qualifications which such an education as I have described would give to them, they "should have the world before them where to choose." If a boy was gifted by nature with superior ability, and had a taste for learning, he would addict himself to the acquisition of knowledge and would rise above his fellows. If he did not possess those qualities, his mind would not have been pampered with educational dainties, and he would not be unfitted for the vulgar occupations of life. He would be a good citizen, working honestly, early and late, at his vocation, as did his fathers before him. Such persons as "village Hampdens" and "mute inglorious Miltons" *may* have existed,—but I do not believe it. Genius, through every difficulty, will make itself known. It will burst the trammels of humble station, and snap the fetters of ignorance. Whether a man be at the plough, or at the loom, or tending sheep upon the mountain slopes, if he possess within him the germ of poetry, or science,—it needs no propagating house to bring it forth,—the ordained incident *will* occur to make it shoot forth and unfold its virgin leaves. No country can prosper, unless it contains a numerous labouring class. Where are our railways, our steam-engines, our line-of-battle ships to come from? Nay, where are we to get the common necessaries of life? Is it wise, then, in our colonies, where the labouring class is so scarce, still further to diminish it, by an injudicious education? I wish not to be misunderstood. I have said that I would educate all,—but the education I would give should be a suitable and a practical one. I would, however, throw no obstacle in the way of those who had talent and taste for higher acquisitions. I would give to a boy such an education as would enable him to become an excellent and contented shoemaker, carpenter, or engineer, or which would afford him the materials with which he might cut his way to the position of a learned professor, a minister of state, or a lord-chancellor. It may seem a harsh saying,—but it is a very true one,—the poor are necessary,—they are an institution,—we cannot get on without them. "The poor ye have always with you," said one, who spoke not as men. And the poor we *shall* have always with us. It is reported to have been said by Henri IV. of France, "that he hoped to see the day when every man would have his fowl under his pot." A very benevolent, but a very shallow observation. If the good Henri had had his wish gratified, there would soon have been neither fowls nor pots. The foregoing observations, however, are intended to apply more particularly to the colonies.

Whatever be the cause or causes, labour does not exist in the colonies in sufficient quantity to develop fully their varied and inexhaustible treasures. Whence is it to come? As far as regards British Honduras, I will endeavour to show. I have frequently addressed you on the subject of the different productions of that possession. They are rich, but not rare. The peculiar political position of Honduras is not unknown to you. In my poor opinion the time has now arrived,—but I speak with the greatest submission,—when that position might safely be altered, and Honduras be placed in the list of British colonies. Many circumstances have recently occurred which would greatly favour the adoption of such a course at the present moment,—at a future time there might be greater difficulty. It is not only in the affairs of men that there is a tide which leads to fortune. The affairs of nations have it also. If British Honduras were declared to be a colony, there are highly respectable and wealthy mercantile houses who would be prepared to enter earnestly into its cultivation. The uncertainty of existing relations alone prevents them.

The price of labour in Honduras is much higher than in any of our West India possessions. The wages are from 12 dols. to 20 dols. per month, with rations. The latter consist of one pound of pork and one pound of flour per day. Sometimes six plantains are substituted for flour. In Antigua and Barbadoes, the wages are from fivepence to eightpence per day; in Jamaica, from tenpence to a shilling. In these colonies the labourer receives no rations. In Honduras a wide field is open for enterprise,—that is, if all uncertainty regarding the tenure of property in that country were removed. There is a theatre for labour,—a theatre for capital; neither the one nor the other is wanting. There is in this city one mercantile house which has long been connected with Honduras as a wood producing country, ready to enter largely into the general trade of that settlement, and procure the labour necessary for developing its resources.

The first place to which one naturally turns his eyes for agricultural labour is the neighbouring province of Yucatan. The Indian population of that district, in consequence of the war which has been raging for many years between them and the Spanish inhabitants (who, by the way, are a mixed race), has been greatly reduced. It does not number at the present moment above 70,000, or 80,000 at the most. A great portion of these inoffensive people might be induced, if the proper means were adopted, to come across the Hondo and engage themselves as agricultural labourers; but they have of late been rather frightened of leaving their own country. A few years ago a villainous system was set on foot, and pursued for some time with success, by certain individuals in Cuba, of entrapping them on board of small schooners on pretence of hiring them as paid free labourers, and then sailing away to that island and making slaves of them. It is much to be feared that the Spanish authorities in Bacalar and Merida had a hand in this treachery. There would not, however, be much difficulty in convincing them of the honour and fair dealing of British merchants, and the poor creatures would be glad to escape from their oppressors.

The mercantile house to which I have alluded would send vessels to Antigua, Barbadoes, Jamaica, and other islands, and give to labourers a passage to Honduras at a nominal rate, and a pledge to convey them back within a certain time if they should desire it. Labour might thus be obtained for cultivating the vegetable products of Honduras at about 8 dols. per month; this rate, although very considerably lower than what is paid at present, is still very far from being bad wages; 8 dols. per month is nearly £20 per annum. To this would probably be added the use of a small piece of land as a provision ground, in which the labourer's family might cultivate a few esculents, such as yams and plantains. Coolies from India and China might also be brought over, if the Government thought proper to advance the necessary funds on the credit of the colony. The expense of bringing able-bodied coolies from Madras or Calcutta would be about 60 dols., or £12 each, and from China about 100 dols., or £20 each. Both the coolies and the Chinese are accustomed to agricultural labour. The latter are very intelligent, and on that account they have been preferred in Cuba, into which island a considerable number have been imported, to the negroes, although they are very much inferior to them in physical strength. There are in Jamaica a large number of Indian coolies altogether unemployed. They wander along the streets and roads begging, and offering for sale a kind of umbrella, manufactured by them of palmetto leaves, in the manner of their own country. They are most of them tall, stalwart, muscular fellows, and capable of doing a very good day's work. They have not been over-well treated in Jamaica. When they arrived it was found that the negro, who, with all the virtues which have lately been discovered in him, is a very exclusive and conceited gentleman (especially when he gets on his black dress coat, white neckcloth, silver ring, and lacquered watch-chain) would not fraternize with them, and they were consequently thrown on their own resources in a strange country. These unfortunate and abandoned creatures are not, as it has erroneously been said of them, unwilling to work; although it is by no means improbable that having been so long unemployed they may have contracted habits of idleness. They, I have no doubt, would be glad to come to Honduras, and engage in agricultural labour for moderate wages. The coolies in India could be hired for 6 dols. per month, and the Chinese labourers for 8 dols. A Government loan for five years of £36,000, at 3½ per centum per annum, would enable the colony to import yearly 4,000 coolies and 600 Chinese at an average of 7 dols. per month; and a tax of 1½ dols. per month to be paid by the hirer, would repay on account of the loan more than half of the sum advanced. Since the lamentable destruction of the vines in Madeira, very efficient agricultural labourers might be obtained from that island. Undoubtedly, the great source of agricultural labour for the tropics is Africa. Some years ago agencies were established on the Kroo coast for the purpose of encouraging the emigration of negro labourers to the West Indies. That attempt, however, was unsuccessful, in consequence of the opposition of the Liberian Government, who claimed to be protectors of the Kroos and other tribes to the north of Cape Palmas. Suspicions were also excited amongst certain parties in this country that the scheme was an attempt to revive the slave trade. The gentlemen who were engaged in promoting this emigration, would sooner have cut off their right hands than have done one single thing which could, in the slightest degree, have renewed so odious a traffic. The feelings which the bare suspicion of such an atrocity aroused were too powerful to contend against, and the scheme was abandoned. It must, however, be said, that a practice of bringing negroes from Africa by private persons, would be open to abuse, and it is unquestionably liable to very grave objections. Unscrupulous persons would have an opportunity afforded them of shipping Africans in their own country, on the pretence of engaging them as free labourers for the British West Indies, and afterwards of selling them to slave owners in Cuba or the Brazils. But if proper safeguards were adopted; if agents were appointed by the British Government in those districts where labourers might be hired, or shipped, to superintend the proceedings, and if the vessels engaged in transporting emigrants should not be otherwise employed during the time they were so occupied, and if a Government officer were placed on board of each of those vessels, there could not then be any apprehension that negroes would be inveighled from their own country to be consigned to slavery. A rule should also be established that prisoners of war should not be permitted to be engaged, but only those who were at liberty, and free to act as they thought proper. The Liberian Government, however, requiring labour themselves, are interested in opposing every scheme of emigration, and, in order to carry their point, have not scrupled to have recourse to misrepresentation and falsehood. They have endeavoured to impress upon the different populations by which they are surrounded, that the emigration proposed would be a repetition of the horrors of the middle passage, and the labour in the West Indies a renewal of former slavery. For the purpose of removing the prejudices thus engendered, some of the chiefs of the different African races were taken to Demerara and brought back again, when they explained to their countrymen the real character of negro labour in the West Indies. This no doubt had a beneficial effect. In Africa, stout healthy labourers may be engaged at tenpence per day, or 6 dols. per month. The cost of the passage would be £7 each, which is about half the expense of bringing over the coolies. I should recommend that each labourer, in addition to his wages, which should be paid regularly every month, or every day, if he wished it, in Cash, should have allotted to his use a small portion of land, for the purpose of raising a few esculents, breeding pigs, or rearing poultry, which occupation might be attended to by his wife. But he should only be permitted to have the *use* of this land as long as he continued in the employment of the proprietor of the soil. If he left his service he should be required to leave his provision ground also, but should be entitled to take away with him the growing crops if they were sufficiently mature to gather, and if not, to receive the value of them. Nothing would be more injudicious than giving the labourers the land, however small the quantity, in fee. If they have land of their own, they *will not* work, neither will they cultivate their own property to any useful purpose. A few yams, plantains, ochroes, peppers, and perhaps a dozen or two heads of Indian corn, are all that they will grow, and for these little or no labour is required. But we wish to have the soil cultivated for the purposes of commerce, not merely for temporary, local provision. For this, capital, skill, and intelligence are necessary. To this subject I intend to draw your attention at another time. My business is at present with labour. The duties and qualifications of the cultivator, the mode of granting land to him, and the price at which it should be sold or let, are separate inquiries.

I hope I have now said enough to show, if Honduras were recognised as a colony, how capital would be forthcoming, and how labour could be obtained for the purpose of bringing that neglected country into fair competition with other colonies in the race of commerce. In the production of fibres and oils it would very soon be foremost. In one vegetable product—the cahoun palm—it would stand alone, and he who first brings the valuable fruit of that tree into general use in this country, surely he shall reap his reward, and in him will be verified the words

Palmam qui meruit ferat.

I am, &c.,

R. TEMPLE.

The Public Libraries Act.—A meeting of the ratepayers of Cheltenham was held recently, convened by the high bailiff on a requisition signed by about thirty gentlemen, to consider the propriety of adopting the Public Libraries Act in that borough. A resolution in the negative sense was, however, carried by a large majority.

Miscellanea.

Coffee as a Deodoriser.—Now that the "sporting season" has again come in, sportsmen and others are reminded that fresh-ground coffee is a perfect and safe deodoriser: a sprinkling will keep game fresh and sweet for several days. Clean your game,—that is, wipe off the blood.—cover the wounded parts with absorbent paper; wrap up the heads, and then sprinkle ground-coffee over and amongst the feathers or fur, as the case may be: pack up carefully, and the game will be preserved fresh and sweet in the most unfavourable weather. Game sent open and loose cannot, of course, be treated in this manner; but all game packed in boxes or hampers may be deodorised as described. A tea-spoonful of coffee is enough for a brace of birds, and in this proportion for more or for larger game. Fresh-ground coffee may be used with advantage in a sick-room; a few spoonfuls spread and exposed on a plate and burned by a red-hot iron, is a safe and pleasant fumigator.

Bessemer's Iron-making Process.—The Staffordshire correspondent of the *Engineer* of Friday, the 19th ult., gives the particulars of an experiment made by the direction of the Messrs. Barker, the managing partners of the Chillington Company, of Wolverhampton. He says:—"On Tuesday last a piece of one of the bars made at Woolwich from iron refined by Bessemer's process was heated and rolled out to a thin sheet at one of the Woverhampton mills. With a view to its being rolled yet thinner, the sheet was then doubled, again heated and again rolled, when it came out duplicate pieces of No. 23 guage, 12 inches long by about 4 inches wide. These were then annealed in the manner customary in the finishing of sheets so thin, and when cold were submitted to the following very severe test. They were taken to a tobacco-box maker in the same town, and, still cold, were punched out into the required shape for such an article. Operated upon first lengthwise and then across, the resistence was the same—perfect. It seemed as ductile as a piece of good block tin. In the words of the workmen conducting the operation, 'it was as as tough as leather.' The box was completed and the burnishing tool applied, when a polish was produced that if the process had been continued a little while longer would have 'equalled,' the operator said, 'the polish of steel.' 'A better bit of iron,' this man said, 'I never worked.' The heating that the iron went through in Wolverhampton was not calculated to improve its quality in any great degree, as all must be aware who are familiar with the process of making plates of a very thin gauge—for the heat imparted is only about red heat. 'From this test, said the intelligent foreman before quoted, 'I am satisfied that the iron refined by Mr. Bessemer's process requires only rolling for the developing of the fibre.'"

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 26th*, 1856.]

Dated 27th August, 1856.

1995. Joseph Manuel Giresse, St. Macaire, France—A new machine to mince tallow and meat.

Dated 30th August, 1856.

2017. Armand Louis André Herbelot, Paris—Improvements in obtaining motive power by gases or fluids.
2019. John Pope, Canterbury—Improvements in the mode of cultivating and treating the hop plant.

Dated 9th September, 1856.

2097. John Watson, 30, Tureen-street, Glasgow, and Charles Frederick Halle, Manchester—Improvements in spinning or twisting fibrous materials.
2099. Hannay Cunningham, Pitarthie, Fife, Scotland—The production of blanks for bank notes, bills, checks, treasury bonds, scrip, stocks, &c., to prevent counterfeiting, &c.
2100. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap.
2101. Richard Archibald Brooman, 166, Fleet-street—An improvement in an apparatus for sprinkling substances in a state of powder. (A communication.)
2102. Charles Brook, junr., Meltham Mills, near Huddersfield—An improvement in polishing or finishing yarns, threads, and woven fabrics.
2105. William Smith, 10, Salisbury-street, Adelphi—A powerful compound whistle. (A communication.)

Dated 10th September, 1856.

2106. Henry Cooke, Manchester—Certain improvements in dyeing yarns or threads.
2107. Charles William Siemens, John-street, Adelphi—Improvements in electric telegraphs and apparatus. (A communication.)
2108. Alexandre Robert, La Villette, near Paris—A new process of treating, smelting, and refining copper, tin, and other refractory metallic ores.

2109. Henry Duncan Preston Cunningham, Gosport, Hants—Improvements in reefing sails.
2110. George Riley, 1, The Grove, South Lambeth—An improved mode of treating maize for distilling, with apparatus therefor.
2111. Johannes Neuenschwander, canton of Bern, Switzerland—Certain improved processes of preparing milk to be preserved.
2112. Henry Gilbee, 4, South-street, Finsbury—Improvements in the manufacture of iron. (A communication.)
2113. John Taylor, Spring-grove, Hounslow—An improvement in building walls.
2114. Joseph Christian Davidson, Yalding, Kent—An improved construction of share drill.
2115. Stephen White, Newlands-street, Everton, Liverpool—An improved method and apparatus for the distillation of certain oils or oily substances from the petroleum, commonly called "earth oil," found in certain districts in the Birman empire, and an improved method of purifying the oils or oily substances so obtained.
2116. Joseph Christian Davidson, Yalding, Kent—An improved construction of hop bin or hop frame.
2117. William Webster, 22, Bunhill-row—Improvements in troughs for feeding animals. (Partly a communication.)
2118. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for making bricks. (A communication.)
2119. William Oldham, Southam, Warwick—Improvements in the manufacture of cement, and in treating or preparing colouring matter for cements.
2120. William Henry Forster, Gravesend—An improved fastening for articles of jewellery, brooches, or dress ornaments.

Dated 11th September, 1856.

2121. John Blythe Robinson, Beverley, Yorkshire—Improvements in machinery for effecting agricultural operations. (A communication.)
2122. John Gedge, 4, Wellington-street South, Strand—Improvements in paint or colouring matter applicable to coating metals and other substances, whereby the oxidation of metal is prevented, and resistance to the action of the atmosphere, rays of heat or acids is secured. (A communication.)
2123. James Hudson, Halifax—Improvements in whetting or setting "printers' doctors," and other straight-edged tools or instruments.
2124. Pier Alberto Balestrini, Brescia, Italy—Improvements in protecting and laying telegraphic wires.
2125. Richard Atkinson Coward, Lawrence Pountney-lane—Improvements in paddle wheels for propelling vessels. (A communication.)
2126. John Milnes and William Thompson, Sutton Mill, Kildwick, Yorkshire—Improvements in looms for weaving.
2127. Lucius E. Truesdell, Warren, Massachusetts, U.S.—An improvement in weight-distributing bridges.
2129. Alexander Chaplin, Glasgow—Improvements in ships or vessels.
2130. Albert Demerit Bishop, Hanover-house, Charlton, Kent—Improvements in derricks for raising sunken ships and other heavy bodies from below water, and moving heavy bodies from one place to another.

Dated 12th September, 1856.

2132. William Stettinius Clark, Camden-town—Improvements in hydraulic heaters or furnace. (A communication.)
2133. John James Leaver, 17, York-street, Rotherhithe—An improved pump for pumping, raising, or forcing water or other liquid.
2134. John Talbot Pitman, 67, Gracechurch-street—Improvements in repeating fire-arms. (A communication.)
2135. Joseph Koronikolski, 36, Lisle-street, Leicester-square—Improvements in baking ovens.
2136. Henry Dubs, Vulcan Foundry, Warrington, and Josiah Evans, Haydock, Lancashire—Improvements in slide valves.
2137. Edward Paton and Charles Frederick Walsh, Perth, N.B.—Improvements in fire-arms and projectiles.
2138. Irénée Leys, Dunkerque, France—Certain improvements in the preservation of cheese.
2139. George Hutchison, 160, Hope-street, Glasgow—Improvements in the treatment of oils and fats.
2140. John Elliott, Southampton—An improved apparatus for containing and supplying water, gas, and other fluids, applicable also to a fluid meter.
2141. Richard Archibald Brooman, 166, Fleet-street—Improvements in treating and purifying water to be used in the washing and scouring of wool, and in other washing and cleansing operations. (A communication.)

Dated 13th September, 1856.

2143. William Whittle, Smethwick, Staffordshire—New or improved machinery for the manufacture of nails.
2147. Frederic Ducimetière Monod, Marseilles—Improvements in the manufacture of chlorine.
2149. Christopher Hill, Great Western Railway, Chippenham Station—Improvements in the manufacture of lubricating matters.
2151. John Buchanan, Katrine, Ayrshire, N.B.—Improvements in propelling vessels.

Dated 15th September, 1856.

2153. John Knowelden, Southwark—Improvements in the arrangement of valves and apparatus for preventing steam-boiler explosions.
2155. Cornelius Ferguson Clements, Liverpool—An improvement in separating copper and other metals from ores containing them.
2157. George Cranstoun Trotter Canstoun, Chirnside-bridge, George Young, Dunse, and John Lovell, Chirnside-bridge, Berwick, N.B.—Improvements in the application of steam for producing a boiling action in bleaching and other manufacturing processes.
2159. Stanislas Chodzko, Paris—Improvements in the manufacture of manure and the apparatus employed therein.

Dated 16th September, 1856.

2161. Alfred Vincent Newton, 66, Chancery-lane—An improved preparation of phosphoric acid. (A communication.)
2163. Robert Walker, junr., 62, Buchanan-street, Glasgow—Improvements in ascertaining the draught of water and trim of ships or vessels.
2165. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—Improvements in power looms for weaving wire cloth. (A communication.)
2167. John Elliott, Southampton—An improvement in taps and cocks.
2169. Robert Mushet, Coleford, Gloucestershire—Improvements in the smelting of iron ores.
2171. Joseph Gilbert Martien, Newark, New Jersey, U.S.—Improvements in the manufacture of iron.

Dated 17th September, 1856.

2173. Charles Marsden, Kingsland-road—Improvements in fastenings for shirts and other garments, together with an improved tag.
2175. John Barber, Manchester—Improvements in machinery or apparatus for mill and other engraving, punching, dividing, and ruling rollers, either for hand or machine engraving, and an improved mandril used in mill, eccentric, and other machinery employed in engraving rollers for printing and embossing calicoes and other fabrics.
2177. William Frederick Spittle, Birmingham—A new or improved spindle for braiding and plaiting machines.
2179. Carl Heinrich Schroder, Altona, Holstein—An improved rotary engine, to be worked by steam or other elastic fluid, which invention is also applicable as a rotary pump for raising and forcing liquids.
2181. Friedrich Heinrich Rudolf Scheller, Vienna—An improvement in the manufacture of illuminating gas.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2131. Constant Jouffroy Duméry, Paris—Improvements in apparatus for counting, registering, and indicating the distance travelled by vehicles, and the speed and time of travelling.—11th September, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed September 26th, 1856.

719. William Armand Gilbee.
727. William Clayton.
733. Richard Durant Cumming.
734. Bonnet Frédéric Brunel.
736. William Ball.
737. Allen Levinston Hill.
744. Alfred Daniel.
746. John Charritie and William Smith.
753. Charles Wye Williams.
760. Herbert Newton Penrice.
769. James Hicks.
778. George Thomas Smith and Joel Watts.
802. Alfred Vincent Newton.
818. Charles William Ramie.
820. Joseph Gilbert Martien.
834. Henry Craigie.
844. William Coles Fuller.
858. Richard Chrimes.
867. Thomas Williams Makin and John Barnsley.
924. John Marsh.
1152. Hugh Greaves.
1202. John Cope.
1436. Walter Henry Tucker.
1446. George Pye.
1484. Leonard Bower.
1582. Thomas Smith.
1601. William Youtman.
1781. Samuel Yeadon and George Chapman.

Sealed September 30th, 1856.

780. Joseph Bentley.
792. Richard Roberts.
793. Peter Mc Gregor and Thomas Marquis.
794. James Smith Cottrill.
796. George Bell Galloway.
808. Thomas White.
822. James Hogg and John Napier.
825. James Webster.
829. Henry Thomas Starley.
831. William Porter Maddison.
838. John Leigh.
870. Peter Armand le Comte de Fontainemoreau.
889. Samuel Cunliffe Lister.
891. Samuel Cunliffe Lister.
894. Alfred Vincent Newton.
920. John Skirrow Wright.
921. George Lurig.
959. Augustin Simeon Vimont.
994. Charles Swift and John James Derham.
997. Robt. Lakin, John Thompson, Edward Gerrard Fitton, and Frederick Alexander Fitton.
1195. William Edward Newton.
1291. Robert Jobson.
1357. Alfred Vincent Newton.
1444. Guilford Lindsay Molesworth.
1594. James Horsfall.
1667. George Tomlinson Bousfield.
1757. George Tomlinson Bousfield.
1854. John Yuil Borland.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

September 23rd.

2197. James Leetch.

September 24th.

2293. Jas. Bullough, John Walmsley, and David Whittaker.

September 25th.

2210. Joseph Ellisdon.
2258. William Henry Wilding.

September 26th.

2277. Samuel Leake Worth and Agmond Diabin Vesey Canavan.
2312. Henry Clayton.
2319. Frederick Warner and John Shotton.

September 27th.

2216. William Prior Sharp, John Hill, jun., and William Martin.

Journal of the Society of Arts.

FRIDAY, OCTOBER 10, 1856.

MEETING OF COUNCIL.

Wednesday, Oct. 8, 1856.

At a Meeting of the Council, held this day, Colonel Sykes, F.R.S., Chairman of Council, in the chair, it was resolved—

"That the Society's Examinations for the North of England be held at Huddersfield, during the week commencing June 1st, 1857."

"That a sum of one hundred guineas be awarded by the Society's Examiners in general prizes at the ensuing Examinations of the Society in June next."

Several Trade schools and Commercial schools having applied to the Society to be taken into union, in order that the pupils of such schools may avail themselves of the Society's Examinations, it was resolved—

"That Trade Schools and such other Schools as profess to teach the elements of manufacturing or commercial knowledge be eligible for admission into union on the same terms as Mechanics' Institutions."*

The following Institutions have been taken into Union since the last announcement:—

420. Bridport, Literary and Scientific Institution.
421. Bristol, Diocesan Trade School.

UNION OF COLONIAL INSTITUTIONS.

At the meeting of the Council held on the 8th instant, the following Colonial Institutions were taken into Union, in accordance with the Resolution of Council of the 19th of December, 1855:—

Royal Agricultural Society of British Guiana.
Sydney Mechanics' School of Arts.
Horticultural Improvement Society of New South Wales.
Mechanics' Institution, Hobart Town.

SUBJECTS FOR PREMIUMS.

(Continued from page 733.)

77. For the production of a perfectly Colourless Copal Varnish, not liable to change or contract, or to injure the colours over which it is applied.
78. For an account of the best methods of dissolving Amber, to make colourless amber varnish for artists.
79. For the production of a Colourless Gold Size, not liable to affect the delicate tints with which it is mixed when used to facilitate their drying.
80. For a pure Colourless Oil suitable for Artists, or for a decolorising agent for linseed oil which will leave its other properties unimpaired.
81. For an account of the manufacture of Garancine, as now practised in France, commencing with the best processes for grinding the root to powder; with observations as to the modifications which might be necessary for rendering similar machinery available for grinding Indian Munjeet or Madder.
82. For the production of cheap Purple and Yellow Lakes, of good quality, suitable for carriage-builders, &c., and not liable to fade or change colour.
83. For the importation into this country from India, Australia, Canada, New Zealand, the Cape Colony, the West Indies, and other British Colonies, of new descriptions of Wood, fitted for manufacture, turning, &c., and not hitherto imported.
84. For the discovery and importation of a Wood suited to the purposes of the wood engraver, and of such dimensions as to supersede the necessity of uniting several blocks.
85. For the best samples of Ornamental Woods from Ceylon, New Zealand, or any other British Colony, new to commerce and suitable for the manufacture of furniture.
86. For the importation of the largest quantity of American White Hickory.
87. For the discovery of an economic and effective substitute for the Teazels used in raising the face or nap of cloth.
88. For the best essay on the distribution of Beds of Shells, and sources of supply of Mother-of-Pearl, especially those hitherto undeveloped by commerce.
89. For an account of the origin, development, and present condition of the Pearl Fisheries of Ceylon, the Persian Gulf, and the Gulfs of Mexico and Panama.
90. For an account of the Sponge and Coral Fisheries, and the development of new sources of supply.
91. For the most complete series of Animal Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, and New Zealand. Each collection to be accompanied by a detailed account thereof.
92. For the most complete series of Vegetable Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, and New Zealand. Each collection to be accompanied by a detailed account thereof.
93. For the most complete series of Mineral Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, and New Zealand. Each collection to be accompanied by a detailed account thereof.
94. For a method of preparing an Engine Size for the use of Papermakers, superior to any now in use.
95. For improvements in the apparatus and processes for Evaporating Brine, and obtaining a pure marketable salt.
96. For the best account of the mode in which Size from Sea-weed is prepared and used by the Chinese.

Classes V. to X.—Machinery.

97. For an account of recent improvements in the construction of Steam Engines, whereby increased power is obtained with diminished consumption of fuel.
98. For an account of the machinery and processes employed in the manufacture of Nails.
99. For an account of the machinery and processes employed in the manufacture of Screws.
100. For a cheap Portable Machine for cutting, squaring, and dressing Stone for building purposes.
101. For an account of the uses of Wire Rope, with a review of its relative merits when compared with hemp rope and chains, particularly for drawing in deep shafts.

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* Purely Classical Schools are not eligible for admission.—*Ed. S. A. J.*

102. For an account of the machinery and processes at present employed on the Continent for Earth-Boring.
103. For an account of any recent improvement in Sawing and Shaping Machines.
104. For an Essay on the application of Steam Power to the cultivation of the soil.
105. For an Essay on the principles which should regulate the construction of Reaping Machines, with a review of those which have been practically tested.
106. For an account of the machinery employed in reaping, drawing, threshing, hulling or shelling, grinding, crushing, cutting, and pulping Farm Produce.
107. For the best method of Drying Corn, both before and after being thrashed.
108. For an account of the best machinery employed in drying, cleaning, grinding and dressing Wheat into flour.
109. For an account of the best machinery for preparing, grinding and dressing Barley and Oats into their respective manufactured constituents, pearl Barley, Groats, &c.
110. For a cheap and effective machine for cleaning and hulling Rice, so that it may be prepared and shipped at the seat of production in a marketable condition.
111. For an account of improvements for Consuming or Preventing Smoke in Glass-works and Iron-foundries.
112. For an account of improvements in Consuming or Preventing Smoke in Dye Houses and Chemical Works.
113. For an account of the methods now in use for working Malleable Iron; and of any improvements in the machinery employed for converting iron into bars, plates, &c.
114. For the best essay on Motive Agents, that have been introduced or proposed, and the peculiarities of the machinery for utilizing the power obtained, with the results of experiments.
115. For the best essay on Electro-Magnetic Engines.
116. For the adaptation of a new submerged Propelling Power in Marine Navigation, which shall possess all the advantages of the screw-propeller, and be more directly acted upon by the moving power.
117. For any practically tested improvements in Diving Bells and Diving Apparatus, calculated to facilitate submarine operations, and suited for the sponge, coral, and pearl fisheries.
118. For an account of the mechanical means at present in use to facilitate the operation of Packing Goods, whether by hydraulic presses, or otherwise.
119. For the best form of Street Goods' Waggon; the improvements required are a lower centre of gravity, and a ready means of loading and discharging heavy packages.
120. For an account of improvements in the manufacture and refining of Sugar.
121. For an account of improvements in the manufacture of Sugar from Beet-root, in Great Britain and Ireland, and of the results obtained.
122. For a Meter to be attached to Stills which shall register accurately for Excise purposes, the quantity and strength of spirit coming over in the process of distillation.
123. For an account of improvements in the Construction and laying out of large Breweries, and the Plant connected therewith.
124. For an account of improvements in the Construction and laying out of large Distilleries, and the Plant connected therewith.
125. For an account of the machinery and processes employed in Sugar-refining.
126. For the invention of a complete system of machinery for making Casks, with an account of the machines at present in use.
127. For an account of the improvements in the construction and arrangement of machinery for spinning and doubling Cotton and other fibrous materials.
128. For an account of improvements in the machinery and processes employed in the Manufacture of Woollen Cloths.
129. For a mechanical substitute for hand labour in running in the outline to the figures in machine-wrought lace.
130. For the best mode of finishing the edges of machine-made Bobbin Lace (in imitation of pillow lace), so as to supersede the use of the separate pearl edge, usually sewn on.
131. For improvements in the machinery for weaving Lace, whereby the outline of the pattern produced shall be worked simultaneously with the production of the fabric, without the intervention of hand labour.
132. For an account of improvements in Thrown Silk and Machinery for producing it.
133. For an account of improvements in the Machinery and Processes employed in the Manufacture of Silk and Mixed Fabrics.
134. For a Bobbin for Silk which shall possess exact uniformity of weight, shall be incapable of being made heavier without instant detection, and that shall not absorb damp from the atmosphere. The material employed must not be liable to chip, or to affect the colour of the silk wound on it.
135. For a Machine which may serve as a substitute for hand-labour in cutting the pile of Velvet and similar fabrics.
136. For an account of the machinery and processes other than hand-labour employed in the production of Embroidered Fabrics.
137. For a Machine for Composing Types, which shall obviate the objections to those already introduced.
138. For an account of improvements in the modes of printing, including the manufacture of Types, Stereotyping, and Printers' Plant in general.
139. For an apparatus or means for damping Printing Paper, to supersede the process of wetting by hand.
140. For an Inking Roller for the Printing Press that will not crack at a high temperature.
141. For a self-acting Counting Machine, suitable for telling off quires or reams of paper at the end of a paper machine or printing press.
142. For the best Ruling Machine, combining delicacy of the lines with distinctness, and more economical than any now in use.
143. For a means, suitable for office use, of Writing, Copying, or Producing a single or several Copies of a Document at one time, by electricity or otherwise.
144. For a rapid means of Reproducing Artistic Designs or Sketches, without the intervention of hand labour, for surface printing by machinery.
145. For the best specimen of Copper-plate and Surface Blocks, produced by the action of Light, Electricity, Mechanism, or otherwise.
146. For a rapid means of Reproducing Artistic Designs or Sketches, and also for Reproducing Copper-plate Engravings (from the plate or from the impression) for Surface-printing by Hand-press or Machinery, without the intervention of *Hand-labour*.
147. For an essay on mechanical and other contrivances for Reducing, Enlarging, Copying, and Reproducing Mechanical Drawings, suited to the purposes of the lithographer, &c.
148. For the discovery of any simple and efficient apparatus for detecting and registering impure states of the atmosphere, either in mines or in over-crowded and ill-ventilated buildings.

149. For the invention of a Voltaic Battery of as great intensity as any at present in use, of less cost, and acting without the production of noxious fumes.
150. For the invention of a simple Electrometer, to be sold at a moderate price, for determining the amount and kind of atmospheric electricity; and which will show uniform results under uniform circumstances.
151. For the invention of a Self-registering Electrometer showing the kind as well as the amount of electricity.
152. For a Self-registering maximum or minimum Hygrometer.
153. For the invention of a Marine Mercurial Barometer, which will obviate the oscillation of the mercury, and fulfil all the conditions necessary to make it a good and reliable instrument; to be sold at a moderate price.
154. For the invention of an Anemometer, for measuring the force and direction of the wind on board ship correctly, distinguishing the amount due to the wind and that due to the ship's velocity, varying with the angle.
155. For a machine that will satisfactorily determine great depths at sea by compression, free from the errors of absorption of air, if that be employed, or from the inequalities of a spring, if that be used; and upon a scale of sufficiently large dimensions throughout to be practically useful and correct.
156. For an instrument that will detect the Local Attraction of a ship at sea with reference to the compass, by direct observation of the heavenly bodies, *without* the process of turning the ship.
157. For a method of rendering the compensating Laminæ of Chronometer Balances permanently sensitive, either by an improved method of manufacture, or by substituting a more suitable metal.
158. For the best means of neutralising the effect of Local Magnetism on the Marine Chronometer.
159. For an Artificial Horizon that can be practically employed at sea, to be used with a sextant, and which will enable the altitude of a heavenly body to be taken with sufficient accuracy for the purposes of navigation.
160. For a Self-registering Maximum Thermometer for great depths at sea, that will not be deranged by checking and hauling up the line, or by the pressure of the water on the bulb, and that will give the maximum of temperature passed through.
161. For a Self-registering Minimum Thermometer for the same purpose.
162. For the invention of a Mercurial Self-registering Minimum Thermometer.
163. For a simple Mechanical Bucket for drawing up specimens of water from moderate depths at sea while the ship is under weigh, and of such material as will not readily affect the water enclosed.
164. For an improved simple Azimuth Binnacle Compass, of moderate price.
165. For a ready means of combining the principles of Great-circle sailing with Physical Geography.

(*To be continued.*)

THE PAPER MATERIAL QUESTION.

By W. Stones.

A temporary rise in the price of paper, about two years ago, drew public attention to the subject of materials for this manufacture, which was still further excited by the appearance of an advertisement in the *Times*, offering a large reward for the introduction of some new suitable substance from which paper could be manufactured in quantity.

Numerous suggestions from all parts of the world having been the result of this announcement, it may not be inopportune, now that the agitation has somewhat subsided, to give a short *resumé* of the whole question, whereby in future much valuable time and money of projectors may be saved, by their becoming acquainted with the results of experiments which have been tried without success, or, if not tried, with the reasons why the propositions contain in themselves the elements of certain failure.

For convenience, I propose to discuss the matter under the several aspects which it naturally assumes, according to the particular point of view selected.

Can it be made into Paper?

This is the first question that presents itself to suggestors, and the reply may be made generally, that almost every vegetable fibre is capable of being reduced to pulp and converted into a substance upon which writing with pen and pencil can be inscribed, or used for some of the various other purposes to which paper is applied. Plantain fibre, hop bine, peat, thistles, nettles, straw, and sawdust, are a few only of the many articles which have been experimented upon, and for many others the curious and interesting book by M. Schaffer, published at Ratisbon, in 1765, and now in the library of the Society of Arts, may be consulted. The good man seems to have been possessed with quite a mania for converting into paper every substance he could procure.

Peculiarity of Rags as Paper Materials.—A peculiar and important advantage attending the use of rags consists in the circumstance that, in their conversion from raw vegetable fibres into woven fabrics they have undergone a thorough cleansing and separation from refuse, a result which would otherwise have to be attained at the paper mill; and the cost of such operation is included in the price paid for the manufactured goods, when purchased as articles of dress, or for other purposes, and no part of the expense attending the process is borne by the paper.

Should the paper-maker, however, resort directly to the vegetable substances in their natural state of growth, the whole cost of the conversion of the raw fibre into paper would have to be defrayed by the paper produced.

This may be illustrated by tracing the course of a single article of apparel, as a shirt; when bought new, the cotton or linen has been gathered, cleansed, spun, woven, in fact, half made into paper; the expense of these operations being paid for in the purchase-money of the shirt, which is regarded by the buyer and seller as the final object of these processes, no consideration that it will make a few sheets of paper when worn out ever entering into their calculation.

Moreover, no other manufacture competes for worn out linen and cotton garments, they being neither ground into shoddy and worked up again into cloth, as old woollen garments of some descriptions, nor used for manure as other woollen goods, and even tinder is becoming a study for antiquarians.

THE LOWEST PRICE OF RAGS.

In estimating the probability of a new material succeeding as a mercantile article, it is desirable to ascertain how its price may range, and whether it could successfully compete with rags when at their minimum price. What is meant by the minimum price of rags?

We have seen that rags are worthless, except for the purposes of this manufacture, and they are necessarily produced in large quantities.

In all civilised countries there is yearly produced a certain fixed average crop of paper materials, the produce costing nothing, and only requiring the payment of wages for the harvest labourers.

Who are they, and how are they paid?

In general it may be taken, that when articles of dress have served their purposes as apparel, they become the perquisites of the family servants, who preserve them until the periodical visit of a rag buyer. He, in his turn, accumulates the small parcels thus obtained, until, eventually, the quantity may be worthy the attention of the paper manufacturer.

The lowest price of rags then, in any given locality, will be the remuneration which the house servant and the rag collector expect for their trouble. If the rag collector will not pay sufficient to induce servants to save the articles as they are discarded, the dust-heap or the fire will probably be their destination, and should he not realise sufficient profit, his rounds will be neglected for some other employment.

It will be evident, also, that in old and populous countries, where wages are lower than in many new countries, the perquisites thus obtained will form a considerable per centage of the ordinary wages, and this item will receive attention; but, in a new country, with wages high, these small ekeings-out will be disregarded, and, by consequence, makers in the former countries will have a larger supply of materials than makers in newer countries.

Successful new materials, even with an ample supply, would not *supersede* rags until they had driven rags down to such low prices, that the classes named would cease to save and collect; but the new articles must also be prepared to fall even to a lower price than the rag minimum, otherwise rags would still be employed.

If, when a rag of a particular quality is 16s. per cwt., a new material were to be introduced at 12s. per cwt., (it is assumed that the expense of manufacture would be the same in both cases) the rag would also go down to 12s.; that is, if 12s. per cwt. would remunerate the servant saver and the collector; and so on, down to the lowest compensating price, when, ceasing to be worth collecting, the rags would be wasted and the new materials used, a state of things not very likely soon to occur.

Sources of Supply.

England produces rags in large quantities annually, the staple materials being, for the finer papers, old linen and cotton garments, and the refuse of the flax and cotton manufactories, particles unsuitable for spinning and weaving; and for the coarser descriptions of paper, old rope, bagging, and similar articles.

Large supplies are also drawn from North and Central Germany, nearly 12,000 bales, equivalent to 1,500 tons, having been shipped to the United Kingdom from one port, Hamburg, in the first six months of the year 1856. Also from the South of Germany and Hungary, *viâ* Trieste, and from Italy, through Leghorn, large quantities are introduced. Many of these being of linen and hemp fabric are useful in imparting strength to paper, when mixed with English rags, of which the preponderating supply is of cotton.

Russia, also, exports large quantities of strong rags of inferior quality.

France, Belgium, and Spain prohibit the exportation of rags, and the paper makers in these countries have thus a monopoly of the rags produced therein, and should their home supply be insufficient, and the foreign markets be lower, the importation of a small quantity restores the balance of supply and demand. The tendency, therefore, in the countries named is to a low and uniform price.

In Germany, rags are very carefully collected, and the amount realised for worn garments would seem to be of consideration to the poor families.

The makers in the United States not only consume all the rags collected at home, but compete with England in the European markets, as many as 2,600 bales having been shipped thither from Hamburg in the six months ending 30th June, 1856.

The American vessels convey bulky goods to Europe, as cotton, tobacco, sugar, and return either in ballast, with emigrants, or with manufactured articles occupying small space. Rags are therefore taken in the vacant room at a low rate of freight, frequently not much more than the carriage to England.

Scarcity.

Much misapprehension has been caused by a vague or general use of this word, and without attempting too strict definitions, it appears to be capable of three limitations in its application.

1st. *Natural or Absolute Scarcity.*—Were a maker to commence the manufacture of paper in Australia, he would soon find that the small population, busily employed in profitable occupations, neither produced nor collected enough rags for his mill; every man would be more willing to buy and read the newspaper when printed, than undertake to collect the rags to make it with, or even to preserve those produced by his own wear. This would be a case of positive, absolute scarcity, and the maker would seek to obtain some new material, as a *substitute* for rags, not an *accessory*, for he would most probably obtain none of the latter.

True, he might compete with the other fields of labour, and offer such a high price as might induce some persons to collect; but the trouble and expense in obtaining a sufficient supply of one class would be such as to preclude the possibility of success, and this must be the case for some years to come. It must be remembered that he could not use one description of material and make writing papers one week and brown papers the next; the machinery once used for the latter, would be spoilt for the former.

2nd. *Partial, or Divisional Scarcity, or Deficient Supply of a particular Class of Rags.*—This may be illustrated by reference to the case of the United States, where there is a comparatively and increasingly large reading public. Rags are produced in certain average proportions of quality, which cannot be altered, nor can the supply of any one sort be arbitrarily increased; but the demand for one description of paper, say printing paper, may increase in greater ratio than the production of the class of rags from which it is generally made, and possibly greater also than the demand for writing paper, hence there will be a comparative deficiency of one sort of rag, although there may be an ample supply of superior rags, which, if used, could only be used at a loss to the maker, or by increasing the price for that description of paper, causing printing peper to approach the value of writing paper. And so far as this scarcity obtains it tends to permanently enhance the price of that one sort of material.*

3rd. *Temporary, Local, and Speculative Scarcity.*—Disarrangement in another manufacture may interfere with the paper material market, thus the strike at Preston stopped the local supplies of cotton waste, and the manufacturers who used that article had, for a time, to employ some other material, the price of which, to all, was thus temporarily raised by their competition in the market.

A drain of one description of rags may be effected by commissions from abroad. Orders may be received in England for the shipment to the United States of certain sorts at given prices; this demand will keep up the prices of that description, while others may decline, and, for reasons previously stated, it would not answer to use a better material, and, by the natural laws of manufacture, the lowest possible quality for the desired result is generally used, therefore a worse could not be employed.

Commissions from the United States and from England frequently affect the foreign rag market for one or two qualities, the others remaining quiescent. By the well-known laws of trade the increased demand for one sort of rag, from the causes named, or any other, raises the price of the whole of that description much higher than merely in the ratio of such extra demand, buyers being anxious to secure and engage supplies prospectively at the present rates for fear of further advance, and possessors holding back, thus conferring a speculative value on the goods temporarily in request.

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* Of the 2,600 bales of rags shipped from Hamburgh to the United States, in the first half of the present year, the large proportion of 1,500 were suitable for making low printing paper only, costing in the port of shipment not more than 10s. 6d. per cwt., the Americans thus endeavouring to make up for the deficient supply of their own production of low goods by importation.

For the most part suggestors of new materials have generally committed the error of assuming the announced scarcity to be what I have termed absolute, and thus mistaken their vocation, which was not to *provide something at any price, but a suitable material at a low price.*

Why Proposed Substitutes for Rags have not been brought into Use.

During the last two years, at least fifty different suggestions have been made, and if a few are specified, it is not for the purpose of censuring the authors, but for the guidance of future projectors.

One gentleman proposed thistles, showing a piece of paper, alleged to have been made therefrom in Hungary, and stating that they could be gathered for nothing everywhere.

Without entering into the question of their suitability, it was pointed out, that, although a farmer might, at present, disregard these weeds, if he found them being collected for some useful purpose he might probably begin to think that he could sell them, and so thistles would acquire a money value, and on the proposer being invited to state his price for the delivery of three or four tons of thistles weekly he began to falter, and declined this necessary part of the venture, but still thought the "idea" worth a good deal.

Another considered that hop-bines would answer admirably; to him it was remarked, that hop-bines were grown in certain localities only, and therefore could afford a very partial supply; that the proposition was not new, had been tried, and even patented, but not carried on, the proposer having only got as far as the "idea," and not having made up his mind how he should treat the material, whether chemically or mechanically; he retired to ponder over this part of the invention, and no more has been heard of his project.

Several instances have occurred in which the projector produced two or three table spoonsful of material, but what it was, whence it came, he declined telling, and how much chemicals had been used he did not know; he had only *just* boiled it three or four times, and used a little acid, and a little chlorine, and so on. On being invited to multiply the firing and chemicals in the proportion of the small quantity exhibited to the tons which must be manufactured to render the matter profitable, the unpalatable conclusions were ignored, even after allowing a large margin for the difference between working several tons and experimenting upon an ounce.

An opinion was always solicited on minute specimens, but all sorts of objections were made to the practical mode of testing the question, by making a ton into paper, paying all the expenses, and ascertaining the result, and yet it must be evident that to this stern trial all suggestions must come at last.

A learned and able gentleman proposed several East Indian fibres as suitable for papermaking, but on inquiring of a large Colonial broker the then current prices of the suggested articles, they were, unfortunately for the theory, quoted as realizing upwards of 50 per cent. more in the produce market for the manufacture of ropes, bags, and sacks, &c., than papermakers were paying for more suitable material.

From the West Indies, also, the Chartered Colonial Fibre Company proposed to import fibres of the plantain, bromelia, yucca, &c., and announced them as being "adapted to the production of paper of the finest quality," at the same time, in another part of their circular, they quote the value as ranging "from £80 to £120 per ton."

It is somewhat vaguely mentioned in their prospectus, after stating that part would be prepared for ropes, &c., that "other portions" are intended "to be applied to the manufacture of paper, of one or more classes."

Until some of the Company's produce is actually in the market, it is difficult to form an opinion as to the profitable working of their projects.

Elements of Success.

There are certain leading questions which every projector should investigate, and be prepared to answer to himself candidly and satisfactorily before the introduction of a new material can assume a hopeful commercial aspect.

1. *The cost or value in its native state or locality.*—It is evident from what has been already stated, that, allowing the article to possess a suitable fibrous character, yet its value for other purposes may be so great that it cannot compete with rags.

As an illustration, the cost of new flax fibre would be too high to admit of its use; on the other hand, straw, without reference to other circumstances, but simply regarding its abundance and price, may be said to be promising;—in the flax the fibre itself is generally expected to pay part of the expenses incurred in growing the plant, the seed paying the residue; whereas, in the other case, the straw, although of importance as litter, is not so much expected to bear the burden of production, the wheat being the remunerative substance.

Peculiar circumstances, such as fiscal arrangements, may, in some instances, lead to the use of an expensive article, which otherwise would not be employed. The duty of 30 per cent. levied on English paper imported into the United States has this double effect;—it enables the American papermaker to use a more valuable material than the English maker can afford when shipping his goods to the American market; the former can thus give the American cotton manufacturers a comparatively high price for damaged and inferior cotton, and he therefore does not work his cotton up so close as the English manufacturer, but makes a choicer selection, throwing out the inferior portions, which are purchased by the papermaker.

By consequence the better quality of American cotton goods, compared with the English made at the same price, causes them to be more approved in India, to which large quantities are exported by both countries.

It is evident that this must be effected at the expense of the American consumers of writing paper, who pay dearer for that article than they need; nevertheless, while the duty remains, these curious results follow.

2. *Its abundance or scarcity*—Many of the substances named would be too scarce to be brought into extensive use. Thistles and nettles may be taken as types of the scarce class, for it must be remembered that it is not the fleshy parenchyma of plants that is required, but the fibre.

3. *Cost of carriage.*—This item attaches heavily to foreign materials. With good writing paper rags at £25, and printing paper materials from £9 to £17 per ton, in England, according to quality, the freight and expences upon new articles, say from India, averaging from £5 to £8 per ton, renders the competition severe, and limits the expectation of relief from that quarter, unless some very superior article were discovered, which could be shipped there at an exceedingly low price.

From other countries the freight and expenses would not be so high; but still they would form a large per centage of the value, and by so much reduce the chance of successful introduction.

4. *The per centage loss sustained in being converted into paper.*—Rags lose to a greater or less amount, according to quality, in the process of manufacture, and more than two tons of straw are required to make one ton of paper.

Assuming a new imported raw material to be of medium waste, say only 30 per cent., the additional freight alone, on account of this loss, would enormously increase the price of the resulting paper, according as freight might rule at the time of shipment, thus precluding its use, except for a high class of paper.

5. *The Chemicals and Machinery necessary to make the fibre into paper.*—The manufacture of paper is partly a chemical and partly a mechanical process.

In the case of fine rags, the tearing up of the material into pulp is accomplished in machines or engines, which would be unsuitable to the beating up of rougher fibres; hence, if such were introduced, additional preliminary machinery would have to be erected, increasing the already large expense of this item.

If, on the other hand, an article of more tender fibre than usual be employed, such as straw, which can be ground with little expense of power, then the chemicals may be excessive, and become a serious, if not the preponderating element in the cost, every ton weight of straw, reckoning it at 40s. per ton, and making only half a ton of paper, requiring 70s. worth of chemicals to effect its conversion into writing or printing paper.

Strange to say, I have never met with an instance in which the proposer could give the slightest estimate of the cost of working his own pet material.

6. *The quality of the paper produced.*—A short time since some paper was experimentally manufactured from wood. The question will suggest itself, Why, with a plentiful material, the carriage moderate, and working expenses not particularly heavy, was not the manufacture prosecuted?

I apprehend the reply is simply this, that the quality of the paper produced was inferior to the rag paper offered in the market, at the same cost of production.

That great jury, the public, right in the main, in the trial Rag *versus* Wood, decided in favour of old rags against its aspiring, though more expensive, wood opponent. Many other similar instances might be quoted.

PROGRESS AND IMPEDIMENTS.

On a careful investigation of the price of rags during the last fifty years, it appears that a gradual diminution in the value of the better class of materials, suitable for the manufacture of writing paper has taken place, but of the lower class, in consequence of the increased numbers of the reading public and improvements in bleaching, there is a tendency to spring upwards in value, and it is more especially in reference to this medium quality of materials that every encouragement should be given to feasible projects for keeping down their price, by increasing the quantity available.

Few complain of the price of writing paper. It is the high price of printing paper which is injurious to so many interests; and it is this sectional deficiency which is to be apprehended more than an absolute deficiency, because, while improvements in the machinery for making and printing paper, and the extension of education and diminution of postage, have increased the consumption of materials, it must be borne in mind that this demand has been to a great extent met by the increased rag-producing power of the community, by the expansion and cheapening of our linen, cotton, and hemp manufactures.

Of the articles which have been yet suggested, it appears to me that the Mississippi cane brake, among the foreign substances, and, of home materials, straw, offer the most promising field.

The former grows annually to a large size, and only requires cutting. The gentleman who exhibited the paper made therefrom, and proposed to ship it to this country cleared of its unsuitable matter, quoted a price at which it might be rendered available.

It does not appear quite clear, however, why, if the operation of half-cleaning could be profitably performed in the United States, the second portion of the manufacture should not be also effected, and the paper imported, the duties on foreign and English paper being now equalised.

Straw abounds at home, and the price is low. The chemical part of this manufacture, although at present objectionably expensive, is being reduced by gradual improvements in the process, and the specimens produced are as satisfactory as the recent introduction of the system could lead one to expect; in fact, paper from this material, although short in fibre, possesses some peculiar advantages. Sold at the rate of an ordinary printing paper, it can be both printed and written on with ease, which cannot be asserted of a rag paper at the same price. It is therefore peculiarly adapted for ephemeral purposes. From sixteen to twenty tons are now manufactured weekly in this country.

But some literary men, who have "fed of the dainties that are bred in a book, and eat paper, as it were, and drink ink," will exclaim, "Why, then, is the staple of our existence so dear, if rags cost nothing except the trouble of collecting, and straw is so cheap?"

It may be trite to remind such of the saying, that a hare and eleven penn'orth of sauce are worth a shilling; but, in truth, there are many other elements entering into the production of a sheet of paper besides rags: wages, interest on outlay for machinery, wear and tear, chemicals, coals, colouring matter, sizing materials, profit, and above all, crushing all, the Excise duty, amounting to between 20 and 30 per cent. upon all the printing paper used, the selling price being from 6d. to 9d. per lb., out of which the duty absorbs within a shade of 2d.

On packing papers it is a much larger per centage of the value, and on writing paper less, but on all it is very oppressive.

In the foregoing observations, which could have been more readily extended than condensed even to their present length, I have endeavoured to refer to most of the mistakes prevalent on this many-sided question, and I trust, in studying brevity, I have not missed explicitness.

Colonial Correspondence.

LABOUR IN OUR TROPICAL COLONIES.

SIR,—The general question mooted by Mr. R. Temple, in his letter, which appeared in the last number of the *Journal*, involves too wide a field for discussion in your columns, but there are one or two points on which he has fallen into error, and which I think require correction.

The want of labour in our colonies is the evil stated, and an explanation of the causes is attempted.

It is true that, on attaining freedom, the negro was unfitted for continued industry, but it is a mistake to suppose that his love of ease leads him to exact exorbitant wages. Mr. Temple himself states the average rate in Antigua and Barbadoes to be from 5d. to 8d. per day, and in Jamaica from 10d. to 1s. It is not the amount demanded, but the unsteadiness of the supply, that injures the prospects of the planter.

Again, it is true that by the sale of waste mountain land, in a few of the islands, the negroes were withdrawn from the plantations, but it is a mistake to assert that the purchasers intended to "found a family," or ever dreamt of "transmitting to their descendants the paternal estate." Mr. Temple shall once more correct himself:—alluding, in another portion of his communication, to the habits of the negroes, he says:—"If they have land of their own they *will not* cultivate it to any useful purpose. A few yams, &c., are all that they will grow, and for these little or no labour is required." Had the feeling above mentioned been the guiding impulse of the small freeholder, there would have been no cause to complain of the result. It is the wasteful system of temporary squatting which causes so much evil to all sections of society.

The third inducing cause specified is as novel as it is striking. Mr. Temple has resided for some years in British Honduras, but he speaks confidently on the condition of the West India colonies in general. I resided for several years in Jamaica, but until I read the letter on which I am commenting, I never heard the suggestion that the standard of education in the colonies was too high. I profess not, however, to pass even an opinion as relating to any other colony than Jamaica. There the *want of education* has been a deep cry ever since emancipation, and I could quote largely from the local journals in support of this statement. I agree with Mr. Temple as to the degree of education required, but I cannot think it necessary to join in his remonstrance against the evil of cramming the negro mind "with metaphysics and logic, history and astronomy, composition and poetry, Latin and Greek, the niceties of grammar, and the subtleties of style."

Passing from the causes of existing evils, the question is stated, "Whence is increased labour to be produced?" and Mr. Temple endeavours to furnish a reply, as far as regards Honduras.

His local knowledge entitles him to the credit of authority, when he points to the 80,000 Indians in Yucatan. If it be true that these people "would be glad to escape from their oppressors," I should have thought such a supply amply sufficient for some years to come. But the proposed new "colony" of Honduras is to draw a further supply from its prostrate sister colonies. "A mercantile house in the City would send vessels to Antigua, Barbadoes, Jamaica, and other islands, and give to labourers a passage to Honduras." This would be a startling statement to the poor old colonists, if there was a shadow of feasibility in the scheme.

We are told that "there are in Jamaica a large number of Indian coolies altogether unemployed. They are most of them tall, stalwart, muscular fellows, and capable of doing a good day's work. They have not been overwell treated. . . . . The negroes would not fraternise with them, and they were consequently (?) thrown on their own resources in a strange country. These unfortunate and abandoned creatures are not, as it has erroneously been said of them, unwilling to work; although it is by no means improbable that, having been so long unemployed, they may have contracted habits of idleness."

It will be well for the "mercantile firm" to postpone the departure of their vessels, not only until the settlement of Honduras is placed in the list of British colonies, but until they shall have obtained further information relating to the unemployed labourers in Jamaica.

I am unable to account for so serious a mis-statement, made with so much particularity by your correspondent. In the first place, there are no coolies in the condition specified, and the vagrant Chinese are utterly helpless, having defied the efforts of the Agent-General of Emigration, and of their own leading countrymen, to settle them in a plantation for the cultivation of rice or ground nuts, which plan was set on foot at the public expense, expressly to attract those who would not work on the sugar estates.

The assertion, that the industrious coolies were ill-treated or neglected in Jamaica, is wholly unfounded. The majority of them returned, greatly enriched to their native country, and those that remained (man, woman, and child) received a pecuniary bonus in lieu of their passage-money.

Should any scheme be set on foot to entice the negro population from the island, I think I can forewarn the parties of a complete failure. The Jamaica people have spent hundreds of thousands of pounds in immigration, and hundreds of thousands of labourers are still required. I hardly think that any mercantile firm would be bold enough to embark in such an attempt to rob Jamaica to enrich Honduras.

It is interesting to observe how widely different are the views of men as to the remedy for existing evils in our West Indian colonies. Mr. Temple, together with many others, advocates immigration of unskilled labour, involving a mixture of races, and the importation of every variety of heathenism. Another view is advocated by a large class, who seek to arrest the influx of such an accumulation of ignorance and vice. If you can find space for the inclosed abstract of a paper lately published in the Jamaica press, you are welcome to its use. The signature will not be unknown to Mr. Temple.

I am, &c.,
LEONARD ROWE VALPY.

5, Spring-gardens.

"How to procure labour for the profitable working of his large fixed capital has long been the all-absorbing question of the proprietor, and no progress has yet been made towards a solution of it. Meanwhile ruin is creeping like a leprosy over our future. . . . Several elements enter into the labour question which have not yet had that attention which is essential to the attainment of just practical conclusions upon it. The condition out of which we have emerged had laws of its own, and gave form and body to a condition of the society which prohibited the advancement of the labouring classes, although these formed the numerical majority. The course of that old economy was to concentrate on single plantations bodies of labourers as large as the landholder's purse could procure; and according to the extent to which he was enabled effectually to cultivate the lands immediately surrounding his building and machinery, so were his profits. . . . In a state of freedom, these considerations must in a great measure be reversed. When the quondam slaves have thoroughly understood their new position all considerations affecting the capitalist will be lost in the consideration of what is personal to themselves. *He* is no longer the lord of *their* movements, nor *they* the creatures of his will; so that motives must be presented to induce them to labour for him at such times and places as *he* shall prescribe, instead of for themselves at such time and places as *they* shall please. This is the true complexion and relative position of capital and labour in this and all other free countries, with which, therefore, we must deal. . . . In agricultural *Colonies*, where the population is thin and the land is cheap, we find the proprietor compelled to restrict his enterprise much within his capital and ability. Were a few wealthy farmers to attempt in one of the new States of America to secure the permanent labour of hundreds or even fifties, to their respective farms, they would utterly fail, unless they were prepared to pay wages far exceeding what their profits could afford. Accordingly agriculture in such countries is upon a corresponding scale of moderation. . . . Hundreds of Coffee and Sugar plantations have been given up; the labourers disengaged were free to do as they pleased. And what did they please? Not to go to the remaining plantations, but turn to on their own account. Hence the anomaly of a cry of "no labour in the country," at the moment of tens of thousands of labouring men being thrown loose from all engagements. Several remedies have been proposed, of which the leading has been immigration of people of a low order, unable to speak our language, but willing to be bound to plantation labour by indentures for terms of years. This scheme has involved the island in a large amount of debt, without apparently having made the desired impression on the labour market; and been accompanied by an appalling amount of suffering, destitution, and mortality. . . . But I may be told that planters do succeed in making large crops, and consequently in attaching large bodies of labourers to their estates. Yes! But with what an effect this is done, and in how many cases with no profit at all; and what little likelihood is there of such efforts being permanently successful, and what a state of society is it creating? These labourers are not located on the estates. They are gathered from a circle of from twenty to thirty miles around the plantation. Fathers and mothers, for example, actually leave their houses in the parish of Portland to labour on the estates of Plantain Garden River and other estates thirty miles off. The working plantations thus become hotbeds of all that is irregular and immoral, and in the highest degree prejudicial to the domestic condition of our peasantry. The Rev. John Cowan, one of the most respected Scottish missionaries, told me that on this account the people of his charge, generally, would not work themselves, nor permit their children to work on the plantations. . . . . The agriculture of a free country must rely on voluntary labour, and the more skilled and intelligent the better. If this be admitted, one of the earliest remedial measures of Government will be to seek for the proper class of emigrants in the Canadian refugees, whose habits are good, and who have been accustomed to a superior style of labour, and to a more civilised social condition than ours. . . . .

"I need not go into a dissertation on the central factory system; but I may ask whether, were an estate with its cane-fields brought under cultivation by a smaller class of capitalist farmers, each of whose profits would be realised, and labour ended when his fields of canes were handed over ripe to the attorney of the proprietor, there would not be a greater facility of raising and ultimately of manufacturing, by the aggregate of what such tenants could and would do, larger crops of canes for the estates? . . . .

"The present system of plantation labour is demoralising and destructive of the amenities of domestic life. The usual wages of a shilling a day is wholly inadequate to support a family, unless combined with a house and provision ground in the immediate vicinity. . . . .

"Where large bodies of people are required, the proper course is the establishment of villages for the location of labourers' families, and for tradesmen offering their workmanship, and shops their variety of merchandise, as the proper stimulants to active and incessant industry. It may be replied that the negroes, generally, are not much bound by common motives or family ties. So much the worse. Are we to be contented with such a condition?" . . . . Whether men will have it or not, the *material* is ever dependant on the *moral* condition of a country—and that by an eternal law of the Creator. Some cannot, and others will not, see this; but results will compel its acknowledgment. . . . While other colonies, with not half her natural advantages, or half her population in proportion to area of land, are advancing in wealth and civilisation, she is sinking into destitution—yea, and will sink until she gets a Government whose ideas of remedial measures shall extend beyond the mere regulation and exaction of revenue, and include the improvement of the people, and their assimilation to those of other well-doing countries as primary objects.

"W. W. A."

Home Correspondence.

FLAX SCUTCHING.—M'BRIDE'S MACHINE.

Sir,—From the great interest that has been awakened of late, regarding the supply of flax and other fibres for manufactures, by the narrow escape we had in the last war, and particularly from the severe trial the flax-spinners experienced, whereby many of long standing failed, such attention was aroused relative to the production of flax at home, and of it and other fibres in our Colonies, as should not be allowed to cool down, now that the danger appears to be past.

For many years I have taken a great interest in, and have paid much attention to, the above subject, and therefore I have been led to watch closely any improvements taking place in machinery for cleaning, or scutching flax; and, having had some experience with M'Bride's first patent machine for such a purpose, it led me to see that, if a few defects therein could be got over, it would be, as nearly as possible, a perfect machine.

While on a journey to the North lately, business led me to cross over to Belfast; and having heard, some short time previously, that a *second* patent had been secured for M'Bride's machine, whilst in Belfast I called upon the Messrs. M'Adam, the spirited engineers there, who had brought out the improved machine, and those gentlemen afforded me every facility for inspecting and making full trial of the capabilities of the machine; so that, having made a careful trial of it during two days, I felt convinced that it was one of the most important movements yet made in the flax trade; and it is now my deliberate opinion that, by means of this machine, it will be possible to prepare and dress flax fit for the English market in any quarter of the globe where the plant can be grown, without regard to the unskilfulness of the inhabitants. The vast quantities of flax straw now thrown away in India could, by the above invention, be made productive of a profit that would induce cultivators generally to secure the same benefit, and if the vast capabilities of that magnificent, but much neglected, part of our possessions were developed, even as regards flax, thousands of tons might annually be produced, that would materially augment the wealth and comfort of the producers and the manufacturers.

This improved scutching machine is less expensive, more simple, more easily managed, and occupies less space and power than did the first machine, although doing fully as much work; it is perfectly self-acting, merely requiring the flax straw to be put in at one side, and the flax, finished, is taken from the other side. From the moment the straw enters the machine no further attention is necessary, and no skilled workmen are required, as any boy or girl of fourteen or fifteen years of age can be taught to feed it in two or three hours—the machine does all, and delivers the flax well scutched.

All clasps or holders for fastening the straw are dispensed with, the attendants are not liable to accidents, and the important object of security from the annoyance of dust is attained, which is so injurious to the health of the workers; for, by simply elevating the machine a few feet, the whole of the tow and the scutching dust pass away beneath, so that, from witnessing this trial, I feel convinced, by the clean fibre yielded, and the small quantities of tow and waste left, flax can be scutched with quite as small amount of loss as by the most careful handling of skilled scutchers, which shows the great advantage of using M'Bride's machine, whereby unskilled labour, at 10d. or 1s. per day, does twice the work of skilled hands at 3s. to 3s. 6d. per day, and the machine can be easily set, so as to dress either green or unretted straw, as well as either cold or hot-water steeped.

The space it occupies is about 17 feet by 10 feet; the holding of the flax is effected by means of a horizontal wheel of about three feet diameter, having on its circumference two grooves, in which grooves, by endless ropes, kept tight by a counter weight, the flax straw is held firmly between the grooves and ropes, to be taken slowly round to the breakers, or scutching blades; *here* the great improvement occurs. These blades are fixed in a peculiar manner, on two horizontal shafts, parallel to each other, but on different levels; each shaft carries arms, placed opposite to each other, so contrived as to pass each other without coming in contact; to these arms the scutching blades are fixed, passing each other in intersecting circles, the intersection taking place immediately *below* the circumference of the holding wheel. The blades strike the flax rapidly, but gently, on either side alternately, whilst it is passed slowly under their action in the grooves of the holding wheel; and, being thus cleaned at one end, it is grasped at the proper moment by the holding apparatus of the second pair of scutchers, being counterparts of the first, but so set as that the other end of the straw is effectually cleaned, and thus the finished fibre passes out ready for the manufacturer.

Messrs. M'Adam and M'Bride, in their own statement of performance of the machine, modestly put down 500 lbs. of fibre cleaned in a day of ten hours, but the result of the two days trial I witnessed gave us, on the first day, 800lbs. of clean fibre, or an average from each cwt. of flax straw of 30lbs. clean flax, but on the following day, with increased speed, 900lbs. were produced in ten hours, on an average of 29lbs. flax from each cwt. straw; yet, by the present expensive mode of hand-scutching, from 20lbs. to 22lbs. is reckoned a fair yield from each cwt. of the straw, showing most strikingly the great advantages derivable from M'Bride's new machine. Thinking that some information relative to the profitable nature of flax culture may be appropriately inserted here, and may also be interesting to some readers, I have copied the following report, made by Mr. S. Druce, of Ensham, near Oxford, to the Royal Agricultural Society, dated 26th Feb., 1851, and also the comparative expenses of scutching by machinery, and by skilled labour:—

Mr. Druce's Report, Dated February, 1851.

Dr.	£	s.	d.
Rent, at 48s. per acre, 5a. 2r. 3p.	13	14	9
Taxes, at per acre, 6s.	1	14	4
Flax seed, 13½ bushels, at 9s.	6	1	6
One ploughing, at per acre 10s.	2	17	3
Sowing and harrowing, at 1s. 6d.	0	8	0
Weeding do. at 2s.	0	11	5
Pulling flax, at 14s.	4	0	1
Carting and stacking, at 4s.	1	2	10
Thrashing	5	7	1
Winnowing	0	12	6
To balance (profit)	47	16	4
	£84	6	1

Cr.	£	s.	d.
Sale of produce, flax seed 116¼ bush. at 8s.	46	10	0
Do. straw, 12t. 2c. 2q. at £3	36	7	6
Chaff, at per acre 5s.	1	8	7
	£84	6	1

The soil on which the flax was grown consisted of a deep loam.

To estimate the profitable result of scutching by M'Bride's machine, it will only be requisite to take out the quantity and value of straw from Mr. Druce's report above, and allow two tons of clean fibre therefrom, at a cost of £9 per ton of flax for the processes of steeping and scutching, which will show a net profit of £45 12s. 6d., valuing the fine fibre at only £45 per ton.

The following are the comparative results of scutching flax by patent machine and hand-labour:—

Observe:—The rolling or breaking the straw being the same either way, it is not taken into account; the prices attached to the estimate for hand labour are stated to be the average paid throughout England.

	£	s.	d.
Hand labour; scutching 40 stone, 7½d., or 640lbs. clean fibre	1	5	0

M'Bride's Machine (New Patent).

	£	s.	d.
Yield in one day of ten working hours; 40 stone or 640lbs., 2 feeders, 1s. at 10d.	0	1	10
1 straightening ends	0	1	0
1 attendant	0	0	10
2 dressers at 3s. 6d.	0	7	0
Wear and tear	0	1	0
	0	11	8
Balance in favour of machine	0	13	4
	£1	5	0

In the important question of flax scutching there is the great cause of humanity involved; it is not so much the money-saving on the cost of working by the new patent scutching machine that should be regarded, but the difficulty also, of securing skilled hand-scutchers, and of keeping them to their work when once trained. Let any reflecting person go for a short time into an Irish scutching mill, and see if he would not be glad to retreat out of the fog of fine dust in which he would be enveloped. Much is said about the drunkenness of the hand scutchers, and the impossibility of keeping them regularly to their work; but, let it be considered, that these poor fellows stand close to the breakers, flying round like the sails of a windmill several hundred times in a minute, and casting off in sticks and dust eighty pounds weight, at least, to every 32lbs. of fibre cleaned; and further, it is not merely one man in a room, but often twenty or thirty, and in some places many more, confined to one place with continual dust to aggravate thirst, and, consequently, the desire to quench it. My own wonder is that the men can be got to work at all, and for this reason, a person who might start a hand-scutching mill will not find it answer; one might as well try to persuade some of our sporting friends on a *Derby Day*, driving along a thronged and dusty road, that they do not need anything to wash the dust down as to persuade these poor scutchers from drinking. In most cases they lose their appetites, then their energy, and thus substitute the stimulus of drink to enable them to toil on in their unhealthy employment. Therefore I say that Mr. M'Bride, for his great ingenuity in contriving, and the Messrs. M'Adam, for their skill in bringing the new scutching machine to perfection, deserve the fullest support, and the best thanks of all who have the success of the commercial and manufacturing interests at heart, combined with the improved condition of our operatives. Thirty years' experience amongst working-men convinces me that nothing is lost on the part of any employer, by studying the comfort of his people.

EDWIN WARD TRENT.

Park Hemp Works, Old Ford, Sept. 29, 1856.

Proceedings of Institutions.

Bucks and Berks Lecturers' Association.—The Second Annual Report of this Association, recently published, states that, whereas when the first Report was printed, in September 1855, the Association had but one Institute, and one reading-room and library in union; one circulating box of books; and had delivered a course of lectures in one school room; now, three Institutes (Egham, Windsor and Eton, and Staines), six reading-rooms and libraries (Burnham, Maidenhead, Colnbrook, Eton, Chalvey, and Cumberland Lodge), and three schools or class rooms (Bracknell, Clewer-road, and Shaw-farm), are in union with the Association. In the establishment of four of these reading-rooms (Burnham, Colnbrook, Eton, and Chalvey), the Association has assisted by grants of money. The circulating libraries of the Association contain about one hundred and fifty volumes; these have been made use of by the reading-rooms at Burnham, Maidenhead, Colnbrook, and Chalvey. Besides these, his Royal Highness Prince Albert has recently most kindly presented the Association with fifty pounds worth of books for circulation. In the course of the past winter, fifty-nine lectures have been delivered by members of the Association in the various Institutes, &c., in union. The committee have much wished to add lay members to its number, as vacancies occurred. Accordingly, Mr. Philips, Honorary Secretary to the Windsor and Eton Literary Institute; T. H. Stevens, Esq., Eton College; and more recently, W. Johnson, Esq., Eton College, have been elected, with much benefit to the Association. It is intended to carry out this principle further. Another way of increasing its usefulness has been opened to the Association. Annual examinations have been established by the Society of Arts, for candidates from Institutions associated with it. A declaration has been signed by a large number of the most influential noblemen, clergy, merchants, and gentlemen in the kingdom, by which they agree "to regard as testimonials worthy of credit such certificates as may be awarded" by the Society. The committee of the Bucks and Berks Lecturers' Association wishing to aid as much as possible such an important object, and to give every assistance in their power to members of Institutes, &c., in union, who may wish to present themselves for examination in London, have determined to hold a preliminary examination in the spring of each year, and to open a special fund for providing prizes. The particulars of the scheme will be shortly forwarded to all Institutes, &c., in union.

HANTS AND WILTS.—The third annual meeting of the Hants and Wilts Adult Educational Society, and the conference of kindred associations in union with it, was held on Tuesday, in the Townhall, Basingstoke.—Among the company were, the Bishop of Winchester, the Bishop of Salisbury, the Dean of Hereford, the Hon. and Rev. J. Best, the Rev. Canon Woodroffe, the Rev. Canon Jacob, the Rev. A. Wodehouse, the Mayor of Basingstoke, Mr. W. Portal, Mr. Chadwick, Mr. Chute, Mr. H. Cole, Mr. J. E. Jervoise, &c. On the motion of the Bishop of Winchester, seconded by the Bishop of Salisbury, the chair was taken by the Dean of Hereford. The Hon. and Rev. S. Best, one of the honorary secretaries, read the Report, from which the following are extracts:—

"In presenting their report of proceedings for the year ending Sept. 1, 1856, the committee venture to congratulate the Society on the success which has attended its labours. The great work of promoting, stimulating, and aiding adult education, is not one which can be accomplished without long continued exertion and patient forbearance. There is much lost ground to make good, and prejudices, interests, and difference of views are to be overcome before we can agree upon any common platform of operations. When this is agreed upon, it will still be necessary to allow for very wide diversities of circumstances and conditions in the arrangements for carrying out our objects. Great as the improvement has been in our elementary schools in their method of teaching, and the more practical range of subjects, it may be questionable whether our greatest difficulty, the early removal of children from school, has not rather increased than diminished, and whether the very efforts we have made to improve school teaching, have not tended to abridge its duration. It is beside our office to enter into this branch of inquiry which belongs rather to the province of elementary than adult education; but as it is our duty to take up the youth as we receive him from the elementary schoolmaster, it is necessarily of vital importance to us and to our hopes of carrying on his education, that his teaching in the elementary school should be sound, enlightened and liberal, that so he may be prepared to receive without risk or danger those impressions that the opening world cannot fail to make, and that the various calls and ramifications of labour, industry and skill necessitate. It has been a question and is one to which the attention of this meeting is called, at what age for the purposes and operations of the society, adult education should be considered to commence. Fifteen is the age that has been hitherto taken, but, judging from the correspondence of many members on the subject of evening schools, there would appear to be a difference of opinion, or at all events of practice, on this subject, and as the starting point of our exertions is a matter of considerable importance, it would be well perhaps, if it be wished that any higher or lower standard should be taken, that the wishes of the society should be formally expressed. During the past year several important institutions have been received into union, while the number of schools and small country reading rooms has increased. Among the number of institutions are those of Fareham, Gillingham, Havant, Lymington, Newbury, Odiham, Poole, Ringwood, Shaftesbury, Titchfield, Warminster, Wilton, and West Cowes. Amongst the schools those of New Alresford, Beechwood, Chawton, Erchfont, Empshott, Farley, Longstock, Pitton, and Woodlands, and among the smaller reading rooms, those of Brightstone, Calbourne, Chilbolton, Longparish, and Hayling Island. . . . . . .

In book purchases for institutions in union, there has been a considerable increase. In 1855, 170 vols. were ordered by the secretary, at the desire of institutions in union, whereas for the present year, 320 vols have been ordered through the agent to the Society of Arts, 100 of which were ordered by the Book Hawking Society, but lately taken into union with us. The books so supplied to the various institutions in union, were at a reduction of 25 per cent. . . . .

At a meeting held at Salisbury, in January last, the subject of prizes was taken into consideration; and it was resolved to offer premiums for the best examinations, according to arrangements to be made by the secretaries. After considering the proposition at subsequent meetings of the committee at Basingstoke, it was resolved to carry it out by the issue of the scheme. Under these proposals, examinations were held in the week of July 14 at Lymington, Alton, and Abbots Ann. The method of conducting the examination was as follows:—An application was made to the president of the Institution to which the candidate belonged, requesting his assistance in the nomination of three members, one or other of whom would be present during the whole of the examination, and report that the answers of the candidates were given without any aid or assistance whatever. The whole was in writing. Two hours in the evening were fixed upon by the president, and allotted to each paper of questions which was sent by that day's post to the president, sealed, and with a special direction on the cover that they were to be opened in the room. The answers also were to be sealed up in the room, and returned with a certificate from the manager to the secretary by the post. Several candidates in the first instance announced their intention of standing, but afterwards, from doubt or distrust of the examination, withdrew. Finally, three members only of the Institutes of Lymington, Alton and Abbotts Ann, were examined. The examination in each case was satisfactory, and the committee, desirous of marking their approbation of the courage and confidence with which these members met the proposals of the society, and subjected themselves to an examination of which they could have no experience, have awarded to each a certificate and a prize, varying according to the value of the examination, and the number of subjects successfully handled. It has awarded, therefore, to Mr. G. F. Skinner, of Lymington, a prize of 30s.; to Mr. W. Blake, of Alton, a prize of 20s.; to Mr. W. Rowden, of Abbotts Ann, a prize of 10s., accompanied in each instance by the Society's certificate. At the same meeting it was resolved by the committee to offer assistance, in the shape of travelling expenses, to any members of Institutions in union who would present themselves for examination at the Society of Arts in June. Here, again, several were in the first instance disposed to become candidates, but afterwards withdrew: one only, Mr. John Hams, of Romsey, presented himself, and your committee are happy to say brought away with him one of the society's certificates. By a subsequent resolution of the committee, passed at the Winchester meeting, it was resolved to give a prize of books to any one earning the society's certificate, and in consequence of this, Mr. Hams will also present himself before you this day to receive his prize. Your committee consider, that in this manner they have carried out the spirit of the recommendations of the Southampton meeting, on the subject of certificates as preparatory to those of the Society of Arts, and would willingly, with your approbation, continue the same offers, and carry them still further by paying all the expenses of those who gain our prizes or certificates at the Society of Arts Examinations. While touching on this subject, it may be well to suggest to this meeting the propriety of addressing the Society of Arts to hold examinations for the south in Salisbury, Southampton, or Winchester. The last subject to which the committee would draw the attention of the meeting, is the declaration of employers of labour, by which they undertake to give value to the certificates as well of the Hants and Wilts Society as of the Society of Arts. A very great boon will be conferred on the cause of education by promoting this object, and by getting those whose attention has not yet been fixed upon it to join in this common and joint declaration of the value of a good education. A most influential declaration has been issued by the Society of Arts. The object of our declaration is to assist it by local ramifications, to enlist local classes and sympathies, and to make known the value which men of sound judgment and integrity set upon a good education."

The meeting was then addressed by the Bishop of Winchester; the Bishop of Salisbury; Mr. Cole, C.B.; Mr. E. Chadwick, C.B.; the Rev. Mr. Best; the Rev. Mr. Kingsley,; Mr. W. L. Sclater; the Rev. C. Paul; the Rev. Mr. Ridley; Mr. C. Sartoris; the Rev. F. Trench; the Rev. D. Underwoode; the Rev. Canon Woodroffe; and other gentlemen. In the course of the meeting the presentation of prizes took place, the prizemen being Mr. G. F. Skinner, of Lymington; Mr. W. Blake, of Alton; and Mr. W. Rowden, of Abbotts' Ann; each of whom had passed a rigorous examination embracing the history and theory of the steam-engine, the physical geography of the British Isles, and English history during the reigns of James II. and William III. Mr. John Hams, of Romsey, also brought away a prize, and was congratulated by the chairman on being the first student from the agricultural district who has distinguished himself at the examinations of the Society of Arts.

LONDON.—ROYAL POLYTECHNIC.—A meeting was held at this Institution on Monday evening, to inaugurate a series of evening classes which are about to be formed in union with the Society of Arts. The chair was taken by the Rev. Dr. BOOTH, treasurer of that Society; and there were also present Dr. Spurgin, Dr. Bence Jones, Dr. White, Mr. Bidlake, Mr. Winkworth, Mr. Banister, Captain Pollock, the Hon. Captain Maude, Mr. Wentworth Dilke, &c. The number of persons in the hall was between 1,500 and 2,000.—The CHAIRMAN said he had much pleasure in giving his humble co-operation to the good work they had in hand, and in tendering them the assistance of the Society of Arts. He was glad to see the cause of mental improvement taken up by the people, because the real work could only be done by the public themselves. There was no use in waiting to see what the state would do. The government desired to promote national education, and would assist them if they could, but what hope was there of any thing being done while public opinion remained so unsettled? Whether it was Lord John Russell, or Sir John Pakington, or Mr. Fox, or any other advocate of education, the result was the same with all—discomfiture and defeat. A generation of men had been born, taught somehow, and absorbed, untrained and uninstructed, into the industrial life of the nation while this conflict had been raging; and what hope was there of its termination? It did not at all follow, that if they built a school house, appointed a master and a committee of management, procured books and apparatus of every kind, and even filled it with boys, they could induce them to learn, Every body knew that the elements of education were exceedingly nauseous, and that to acquire them involved, even in the most favourable cases, an enormous amount of mental toil and patient drudgery. They must hold out some inducement to boys to learn. Prizes soon lost their effect; the bait would seldom take more than once. Did they not all know that the average age at which boys were being removed from school was diminishing from year to year; that it had gradually fallen from fourteen down to nine, and even in some cases to eight years? While, in fact, the state was adding at one end, the public were cutting off at the other. He (Dr. Booth) believed that the law of supply and demand would hold in this case as well as in every other. If parents found that their sons could not get on in life without education, why they would endeavour to procure education for them. If young men were made to feel that industry, diligence, and consequent attainments were passports to employment, they would soon see the class-rooms not only of this institution, but of every similar one in the country, filled. But how did a young man now prepare himself to obtain employment? By pestering the members of the borough, if he lived in one, or by running after any railway director or municipal official he can get hold of—nor was he much to be blamed for this. So long as the qualifications of candidates were the last things to be considered in filling up appointments they could not expect that qualifications would be much improved. It was a great mistake to imagine that red tape was only to be seen in government offices—they would find nepotism and partiality elsewhere just as well. In short the matter came to this—if the great employers of labour desired the people of this country to be better instructed they had only to insist on a higher standard of attainments than they did at present. The Society of Arts was proceeding to test the question whether there was such a feeling in the country. If their certificates became passports to employment thousands would endeavour to obtain them. If they did not become so they would not be worth the paper on which they were written. —The Rev. Mr. BUTTERWORTH OWEN then addressed the meeting, and further explained the nature of the arrangements between the classes now to be formed with the examinations at the Society of Arts, by which means a central academy of sciences will be established. He said that this attempt deserved every success, and it was clear that no one at the head of it could hope to reap any money-advantage from it, for the charge for lessons was so low, that the payments, even with success, would barely pay the expenses of the management, and, therefore, the greatest credit was due to Mr. Pepper for the liberal manner in which he had taken up the subject. He thought that authorities of all ranks ought to support such efforts in antagonism to idleness, inebriety, and ignorance. The reverend gentleman concluded by reading the following list of classes:—*Monday:* Arithmetic and Algebra, from 7 to half-past 8 o'clock p.m.; Dr. White, F.C.P., Member of the Council and Examiner in the Royal College of Preceptors; text books—Colenso's Arithmetic and Algebra. Chemistry, from 20 minutes to 9 to half-past 9 o'clock p.m.; J. C. Buckmaster, Esq., of the Department of Science and Art, and J. H. Pepper, Esq., F.C.S., A. Inst. C.E., &c.; text book—Wilson's Chemistry, by Chambers,—*Tuesday:* Geometry and mensuration, from 7 to half-past 8 o'clock p.m.; Geo. J. Tear, Esq., C.M.D., of Training College, Winchester; text books—Tate's Mensuration, and Pott's Euclid. Geography, from 20 minutes to 9 to half-past 9 o'clock p.m.; George A. Chapman, Esq., C.M., of St. Mark's College, Chelsea; text book—W. Hughes's Geography —*Wednesday:* History and literature, from 7 to 8 o'clock p.m.; the Rev. C. Boutell, M.A., Oxon; French, from a quarter past 8 to half-past 9 o'clock p.m.; Mons. G. Roublot, Bachelier es Lettres; text books—Smith's French and English Pocket Dictionary, De Fiva's French Grammar, Montesquieu's Grandeur et Décadence des Romains, and Voltaire, La Henriade.—*Thursday:* Mechanics and elements of mechanism, from 7 to half-past 8 o'clock p.m; John Bridge, Esq., M.A.; text book—Lardner's Handbook of Mechanics. German, from 20 minutes to 9 to half-past 9 o'clock p.m.; M. Heidenheim, Esq., Ph.D.; text book—Ahn's Exercise and Grammar. —*Friday:* Bookkeeping, from 7 to 8 o'clock p.m.; Alex. Macpherson, Esq., Public Accountant; text book—Chambers's Elements of Bookkeeping.—Mr. BUCKMASTER moved a vote of thanks to Mr. Butterworth Owen.—Mr. PEPPER seconded the motion, which was carried by acclamation.—Mr. BUTTERWORTH OWEN acknowledged the compliment, and some other speakers followed to a similar effect, when the meeting terminated.

THE EXPERIMENTAL IRON PAVEMENT laid down in Leadenhall-street, opposite the Church of St. Katherine Cree, does not exhibit that fixedness and stability so essential to be regarded in the pavement of the permanent carriage-ways of the metropolis. The various compartments in which this pavement is laid down already show very considerable indications of wear, and the vibrations to which they are perpetually subjected show a certain looseness and want of tenacity and endurance, the reverse of which is the characteristic of granite paving, especially when properly laid in the narrow-guaged courses.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 3rd*, 1856.]

Dated 18*th July*, 1856.

1690. William Leuchars, 38, Piccadilly—Improvements in locks for travelling bags.

Dated 26*th August*, 1856.

1993. Samuel Jay and George Smith, 246, Regent-street—An improved "facing" or covering to be attached to the outside of ladies' dresses, mantles, or other articles of attire, peculiarly adapted for the warmth and protection of the chest.

Dated 4*th September*, 1856.

2049. James Picken, Dunlop, Ayr, N.B.—Improvements in the arrangement of the feed apparatus of machines for threshing or separating grain.

Dated 13*th September*, 1856.

2144. Richard Peyton, Birmingham—An improvement or improvements in the manufacture of metallic bedsteads and other articles for sitting, lying, and reclining upon.

2146. James Stuart Vaughan, Stockland Vicarage, near Bridgwater—An improvement or improvements in the apparatus for making infusions of vegetable or other substances.

2148. Richard Archibald Brooman, 166, Fleet-street—Improvements in mills. (A communication.)

2150. Samuel Cunliffe Lister, Manningham, near Bradford, York—Improvements in preparing and spinning cotton, flax, and similar fibres.

Dated 15*th September*, 1856.

2154. Jean Baptiste Justin Lassie, 39, Rue de l'Echiquier, Paris—A new system of aerial navigation.
2156. Calvin Kline, Brooklyn, New York, U.S.A.—The improvement of mariners' and other compasses, by which the effect of local attraction is cut off or neutralized, and the compass is made to traverse more perfectly.
2158. Alexander Rowand, Glasgow—Improvements in cases or vessels for holding gunpowder.

Dated 16*th September*, 1856.

2160. Robert Elmy Garrood, Chelmsford—Improvements in stopcocks and valves for the drawing off and passage of air, gas, steam, water, and other fluids, or for any other purpose for which the same may be applicable.
2162. Alfred Vincent Newton, 66, Chancery-lane—Improved apparatus for raising water by atmospheric pressure. (A communication.)
2164. Robert Lavender, Aldersgate-street, and Edward Lavender, Aston-street, Limehouse—Improvements in raising water and other fluids, and in obtaining power thereby.
2166. Richard Archibald Brooman, 166, Fleet-street—Improvements in water-closets and night stools. (A communication.)
2168. Robert Mushet, Coleford, Gloucester—Improvements in the manufacture of iron.
2170. Robert Mushet, Coleford, Gloucester—Improvements in the manufacture of iron.

Dated 17*th September*, 1856.

2172. Robert Burns, Liverpool—Improvements in bone mills.
2174. David Crichton and James Cathcart, Manchester—Improvements in looms for weaving.
2176. Antoine Andraud, Paris—Certain improvements in wheelbarrows.
2180. George Davies, 1, Serle-street, Lincoln's-inn—Improvements in apparatus for actuating railway breaks. (A communication.)
2182. John Muir Hetherington and James Gee, Manchester—Improvements in flyers for preparing cotton and other fibrous substances for spinning.

Dated 18*th September*, 1856.

2183. Isham Baggs, Manchester-street, Argyle-square—Improvements in smelting or reducing copper and other metals from their ores, and in the manufacture of sulphuric acid in or by such process.
2184. Thomas Callender Hinde, Birmingham—An improvement or improvements in the manufacture of iron.
2185. Theophilus Horrex, South-square, Gray's-inn—Improvements in means or apparatus to facilitate the delivery of coals to cellars and other such places.
2186. Louis Jacquemier, Rome—An improved method of hardening and colouring alabaster and other gypsums, and calcareous stones and earths. (A communication.)
2187. George Hill, City-road, Derby—Improvements in feeding steam-boilers.
2188. André Gabriel Guillaumin, Paris—An improved ramrod.
2189. Richard Wilson, Oxford-court, Salters'-hall—Improvements in the construction of fire-proof floors and ceilings, applicable in part to the construction of bridges and other structures.
2190. William Frederick Plummer, St. Mary's Overy Wharf, Southwark—An improved mode of preparing hard wheat and other hard grain for grinding.
2191. Thomas Greenwood, Leeds—Improved machinery for trimming the teeth of wheels.
2192. William Henry Cooper, Manor-cottages, Bromley-hall—An improvement in the manufacture of fretwork for ornamental windows or lights, applicable also to the cutting of irregular figures in glass generally.
2193. Charles Goodyear, junr., Leicester-square—Improvements in the manufacture of penholders and handles for penholders.

Dated 19*th September*, 1856.

2194. Jean Baptiste Honoré de Roussen, 39, Rue de l'Echiquier, Paris—Certain improved apparatus for washing and cleansing ores.
2196. Charles Fréderic Vasserot, 45, Essex-street, Strand—Improvements in filtering water on a large scale. (A communication.)
2197. James Smale, Gibraltar-row, Southwark—Improvements in the mode, means, or apparatus for printing or transferring designs or letters on to glass.
2198. Pierre Lafitte, Paris—An improved engine with rotary piston, applicable to various purposes.
2201. Arthur Clark, 83, High-street, Southampton—Improvements in signal lamps.
2202. William Young, Queen-street, Cheapside—Improvements in furnaces, fire-places, and stoves.
2203. Edward Finch, Bridge Works, Chepstow—Improvements in the construction of wrought-iron masts, bowsprits, yards, booms, gaffs, and spars, and in rigging ships.
2204. George Dawes, Union-street, Southwark—Improvements in the manufacture of hats.
2206. Richard Van Hees, Manchester—Improvements in the construction of electric clocks or time-keepers. (A communication.)

Dated 20*th September*, 1856.

2207. John Sherar, Aberdeen—Improvements in oil and spirit lamps by the formation of burners obviating shadow.
2208. Richard Van Hees, Manchester—Improvements in the construction of wrought-iron wheels for railway and other purposes. (A communication.)
2209. John Naylor, Birmingham—Improvements in window fastenings.
2210. William Johnson, 47, Lincoln's-inn-fields—Improvements in steam-boilers. (A communication.)
2211. The Hon. William Erskine Cochrane, 5, Osnaburgh-terrace, Regent's-park—An apparatus for converting crude iron while in a fluid state from a blast or other furnace into malleable or bar iron and steel.
2212. Joseph Maudslay, Lambeth—Improvements in fire-places for steam-boilers.
2213. Thomas Webster Rammel, Trafalgar-square—Improvements in constructing railways and propelling carriages thereon.
2214. John Roberts and James Beech, Walsall—A new or improved railway chair.
2215. Alfred Ford, Chelsea—Improvements in dissolving vulcanized india-rubber for waterproofing and like purposes.
2216. George William Sayer, Mark-lane—Improved machinery for stopping or retarding railway carriages. (A communication.)
2217. Thomas Evans Blackwell, Clifton, Bristol—An improved mode of constructing fire flues and air passages.

Dated 22*nd September*, 1856.

2218. William Taylor, Woodhall-cottage, Shipborne, Tunbridge—Improvements in the conversion of cast-iron into steel and malleable iron.
2219. Robert Mushet, Coleford, Gloucester—Improvements in the manufacture of iron and steel.
2220. Robert Mushet, Coleford, Gloucester—Improvements in the manufacture of iron and steel.
2221. William Bush Sellers and Abraham Sellers, Sheffield—An improvement in "ever-pointed" pencil cases.
2222. Joseph Wilson and Charles Wootton, Birmingham—A new or improved screw wrench. (A communication.)
2223. John Morrison, Birmingham—A new or improved penholder.
2224. Thomas Wallace, Limehouse—Improvements in the manufacture of wheels, axles, and axle boxes.

WEEKLY LIST OF PATENTS SEALED.

Sealed October 3*rd*, 1856.

814. Robert Halliwell.
816. Samuel Fisher.
846. William Henry Gauntlett.
878. Francisco Nuibo y Pedros.
982. John Yeomanson and William Yeomanson.
1002. William Edward Newton.
1632. Paul Prince.
1756. George Tomlinson Bousfield.
1764. George Tomlinson Bousfield.
1788. William Edward Newton.
1826. William Franklin Shaw.

Sealed October 7*th*, 1856.

848. Stephen Johnson Gold.
852. William Joseph Curtis.
856. Joseph Robert Whitgreave.
861. Henry Laxton.
868. Lewis Normandy.
886. Louis Pierre Coulon.
906. David Blair White.
927. Thomas Hollingworth.
936. Claude Meret.
949. Samuel Mellor and Thomas Young.
957. Alexander Symons and Edward Burgess.
958. Alexander Symons and Edward Burgess.
968. Rd. Archibald Brooman.
987. Victor Deat.
995. Isaac Daniel [illegible].
1006. Thomas Heiffor.
1140. Alphonse Meillet.
1656. Alfred Vincent Newton.
1672. Alfred Vincent Newton.
1820. William Wood and Matthew Smith.
1821. William Wood and Matthew Smith.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

September 30*th*.

2248. Samuel Murland.

October 1*st*.

2251. Robert Halliwell and William Johnson.
2285. Manuel Fernandez de Castro.
2287. Henry Goddard.
2289. John Rubery.
2305. Joseph Denton.
2497. John Johnson.
2551. Thomas Irving.

October 3*rd*.

2261. Peter Rothwell Jackson.
2309. William Potts.
2316. George Ferguson Wilson.
2317. George Ferguson Wilson.
2318. George Ferguson Wilson.
2412. George Collier.
2414. Charles Barraclough.

October 4*th*.

2343. Edme Jules Maumené.
2385. Antoine Corvi.
2420. André Alexander Beaumont.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3880	Sept. 26.	The Roller Action Pillar Pump	Thomas Frederick Hale.........	Bristol.
3881	" 26.	Metallic Pen......................................	Joseph Gillott	Birmingham.
3882	" 29.	Separating Cheese Vat	William Giles Speed	Shepton Mallet.

Journal of the Society of Arts.

FRIDAY, OCTOBER 17, 1856.

POPULAR SCIENCE AND EDUCATION.

The following letter has been addressed to the members of the Yorkshire Union of Mechanics' Institutions, by Edward Baines, Esq., President.

TO THE FRIENDS OF EDUCATION.

Gentlemen,—It is known to many of you that the Society of Arts is co-operating with the Mechanics' Institutes of England to promote the extension of practical science and useful knowledge. Believing that the cooperation of this valuable Metropolitan Society with our popular Provincial Institutes may produce great good to the cause of education, I venture to ask your attention to the facts. And I would solicit the attention not only of the Committees of Mechanics' Institutions, but of all young men above the school age, to the explanation I am about to give. Especially would I ask it at this time, because of a determination just come to by the Society of Arts, and because we are approaching that season of the year which is peculiarly favourable to study.

The "Society of Arts, Manufactures, and Commerce" is an association of the friends of improvement in science and art, which has existed for a hundred years in London, but which has lately assumed great activity. It was a principal means of carrying out, with the important aid of Prince Albert and others, the Great Exhibition of 1851. Since that time it has sought to assist the Mechanics' Institutions of England in their valuable efforts to popularise the study of practical science and art. One of the most important methods adopted for this purpose has been the establishment of a yearly Examination of pupils in such Institutions, and the granting of Certificates to all who have attained respectable proficiency in any branch of useful knowledge. The first of these yearly examinations took place last June in London: the results were highly satisfactory, and, amongst others, five pupils of the Leeds Mechanics' Institution obtained fifteen Certificates for their attainments in Mathematics, Mechanics, Chemistry, Bookkeeping, Geography, English History, and the German language. These Certificates are not only honourable, but they will beyond all doubt be of practical utility to the young men in obtaining profitable employment—some in public offices, and others in various departments of industry. Two of the Leeds students have already obtained employment—one in a public office. But the numbers of students who went up for examination was much less than was to be desired, owing in a great measure to the expense of travelling from distant places to London. In order to remove or materially diminish this inconvenience, the Council of the Society of Arts have resolved to hold separate Examinations next Spring for *the North of England:* and the Chairman, the Rev. Dr. Booth, who attended the last annual meeting of the "Yorkshire Union of Mechanics' Institutes" at Middlesbro', was so much pleased with the evidences of spirit and energy in the Institutes of Yorkshire, that he proposed to hold those Examinations in conjunction with the next annual meeting of our Union. That meeting is to be held, as previously determined, at Huddersfield, in Whitsun week of 1857. Finding that the Committee of the Yorkshire Union approved of the proposal, he submitted it to the Council of the Society of Arts; and this morning I have received the following note, communicating the result:—

"Society of Arts, Manufactures, and Commerce,
"Adelphi, London, October 9, 1856.

"My Dear Mr. Baines,—You will be glad to learn that the Society of Arts will hold their Examinations for the North of England at Huddersfield, next June. The Council came to that determination last evening. They have also voted *One hundred guineas* for prizes.

"I trust this movement will stimulate the young men of the Classes of the Institutes of the Yorkshire Union, and with God's blessing, it may be made a great national success. I shall be glad to receive any suggestions from you, should such occur to you.

"Believe me, my dear Mr. Baines,
"Yours faithfully,
"E. Baines, Esq. "JAMES BOOTH."

I hasten to make this decision known to the Mechanics' Institutions of Yorkshire; and I may venture to say in their behalf that they will give the Society of Arts a Yorkshire welcome. The examinations will not be confined to them alone, but will be extended to the Institutions of Lancashire and all the North of England. But perhaps we in Yorkshire are specially called upon to endeavour to make the examinations successful; and certainly we shall be anxious not to cut a poor figure in them. Happily at Huddersfield, where the meeting will take place, the Mechanics' Institution has the most numerous, if not the best, classes of any Institution in England. But Leeds, Bradford, Halifax, Wakefield, Sheffield, York, Hull, and all our other towns, and even villages, will have an opportunity of sending candidates to the examinations, and of carrying off as many Certificates as they may deserve. They will also be met by candidates from Manchester, Liverpool, Newcastle, and other important places.

The Prizes are a good feature, and perhaps the Hundred Guineas voted by the Society of Arts may be considerably added to by donations of other Institutions, or of noblemen and gentlemen who approve of the object. It is conceivable that the Prizes might be made very numerous, and of respectable value, if the friends of education should send us their Ten Guineas, Five Guineas, Two Guineas, or One Guinea, to swell the sum. I am sure the Treasurer of our Union (Wm. Beckett Denison, Esq., of Leeds) would most gladly receive donations for this special purpose. I hope it will not be considered presumptuous if, as President of the Union, I offer first my own small donation of Three Guineas. I should propose to place any sum that may be contributed entirely at the disposal of the Council of the Society of Arts, for distribution as prizes at the North of England Examinations; but the Committee of the Yorkshire Union will readily be the medium of conveying any contributions that may be entrusted to it.

Whilst regarding the Prizes as a legitimate and useful stimulus, especially in the first instance, I would point out that the mere possession of a *Certificate* from the Society of Arts would itself be a prize well worth contending for. Comparatively few may win pecuniary prizes; but very many may obtain certificates, which would be honourable and valuable attestations of attainments and character. It is not merely to the first in the race that Certificates will be given, but to *all who run well.* Therefore none need be discouraged who have the spirit and perseverance to apply even moderate faculties to attain proficiency in any of the following subjects:—

Mathematics,
Book-keeping,
Mechanics,
Chemistry,
Physiology,
Botany,
Agriculture,
Geography,
English History,
English Literature,
Roman History,
Latin,
French,
German,
Free-hand Drawing.

It is known that a very great number of gentlemen, beginning with the Archbishop of Canterbury, and including noblemen, judges, ministers of state, ministers of religion, members of parliament, lawyers, bankers, merchants, manufacturers, &c., have signed a declaration, stating that they consider the certificates of the Society of Arts of real value, as attesting not merely intellectual attainments, but good habits and character: and would consider a person possessing such a certificate as bearing a strong recommendation to trust and employment. No man of sense can question, that he who has been a successful student has one important evidence that he is a man of virtue and of honourable aspirations. Next in value to true religious principle comes the habit of virtuous industry: and though, unhappily, the two are not always combined, wherever I found the latter, I should have more hope of finding the former.

It need scarcely be remarked that, if the effect of the proposed Examinations should be very greatly to increase the number of young men in Yorkshire who join Mechanics' Institutions, and devote the evenings of the coming winter to regular and persevering study in their classes, the benefits would not stop with the prizes and certificates which may be won next Whitsuntide. So far from it, if we could suppose all the money and certificates buried in the sea, there would remain what is infinitely better—*the attainments realized, and the habits or characters formed, by the young students.* We might then be reminded of the excellent fable of the dying man, who told his sons to dig in his vineyard for a treasure: they dug the vineyard over and over, and found no money; but the next crop of grapes was so large in consequence of the digging, that it was a treasure of great value. And so, though we should not obtain the money, we should certainly find that which was more than money's worth —good character, regular habits, knowledge, industry, and virtue. These are the highest wealth of a man or a nation.

It cannot be doubted that the Committee of the Mechanics' Institutions of this county will regard the intended examinations as a call to them to put their classes immediately into the most efficient state, and to invite all the young men around them to become students. We may possibly find the visit of the Society of Arts, with the establishment of examinations and the granting of certificates in the North of England, a turning-point in the history of Institutions like ours. It may so awaken the attention of our youth to the advantages of knowledge, and so kindle their generous ambition, that our halls and class-rooms may be crowded during the coming winter. Is it not clearly the duty of every Committee to do all in its power to promote such an effect? Will they not forthwith meet and consider of every means by which the effect may be produced? Will they not endeavour to have large classes, good teachers, and the best system of class-instruction? If there are any Institutions without classes, it may be hoped they will at once establish them.

I last year recommended a general canvass of every town and village, to be conducted in the months of October and November, for the purpose of making our Institutions known to the entire population, and attracting the young to partake of their benefits. I appealed to the working-men—such of them as appreciated the advantages of knowledge—to make a personal effort for the elevation of the intellectual and moral condition of their own class, by organising a canvass to bring them into the Mechanics' Institutions; and I appealed to the young men to do the same thing for their young companions. The Yorkshire Union, at its annual meeting, expressed its warm concurrence in these recommendations. I therefore now, with the more confidence, and and with an additional reason, invite attention to the subject of an efficient canvass, by a special committee connected with the Committee of the Institution. And I add the great desirableness of having persons attending in each Institution daily to welcome applicants, and to assist them in choosing classes or departments of instruction.

A few words, in conclusion, addressed especially to the young, on the advantages of regular study in evening classes. It would be difficult to praise them too highly. A library is valuable, and lectures are interesting; but the department of an Institution which does far more good than any other is that of the classes, in which young men obtain systematic instruction. General reading of books, magazines, and newspapers certainly gives information; but unless there is a foundation of systematic knowledge to build upon, it does not become fixed in the mind; and the reader is what Shakspeare calls "a man of shreds and patches." A young man who has acquired a knowledge of mathematics has got the key which admits him into many departments of practical science and art. He has the preliminary qualification for becoming a mechanic, a chemist, an engineer, an architect, a builder, a surveyor, a natural philosopher, an astronomer, or a navigator. And having obtained this preliminary knowledge, the special application of it to various practical and scientific uses is comparatively easy. He can only obtain this master-key by steady application; but that application itself is the means of strengthening and disciplining his mind for all kinds of work. Similar remarks may be made concerning various other branches of knowledge. Every person pursuing a trade or profession dependant on machinery or on chemistry may learn the scientific principles on which it rests by studying in the evening classes of a Mechanics' Institution. He who knows principles has a more perfect knowledge of practice; and, as he pursues his business more intelligently, he is also capable of making improvements which an uninstructed workman could not make.

The importance of having our population acquainted with mechanical and chemical science, and with the art of design, is admitted by all who know the progress which other nations are making in manufacturing skill. Persons who are wholly unconnected with those kinds of industry may study book-keeping, modern languages, geography, and history, and may thus qualify themselves either for mercantile pursuits or public employment. It will be seen that agriculture and botany are also subjects in which the Society of Arts examines students.

If the considerations submitted above are of weight, may we not hope that the friends of popular education in Yorkshire will take advantage of present circumstances to begin anew their public-spirited labours? If we are to reap next summer, we must sow our seed this autumn. Let this month of October not pass before the plan of the winter campaign is laid, and the forces for conducting it organised. Let a bold invasion be made on the dark domain of ignorance. Let the coming winter be the most active and useful season we have ever known. Then will Yorkshire stand honourably in the Examinations next Whitsuntide, and her towns and villages will rejoice in the extension of sound knowledge and good habits among their people.

I am, Gentlemen, your most obedient Servant,

EDWARD BAINES,

President of the Yorkshire Union of Mechanics' Institutes.

Leeds, Oct. 10, 1856.

TO THE CANDIDATES WHO OBTAINED CERTIFICATES IN JUNE, 1856.

Application has been made to the Secretary, by one of the principal philosophical instrument makers in London, to recommend, as an assistant in his establishment, a gentleman possessing a competent knowledge of chemistry, natural philosophy, and the French language, whose age is not less than 25 years, and who has been accustomed to take an active part in a house of business. The remuneration would not be less than £80 per annum. Applications (from certificated candidates only) will be received by the Secretary at the Society's house.

SUBJECTS FOR PREMIUMS.

(Continued from page 745.)

CLASSES XI. TO XXIX.—MANUFACTURES.

TEXTILE FABRICS AND MATERIALS.

166. For the production of a lustrous Wool, to be used in lieu of silk, in the manufacture of fringes, carriage-laces, &c.
167. For the best specimens of Woollen Velvets and Velveteens, of a moderate price, not liable to fade or become rusty, and especially suitable for furniture and the interior of carriages.
168. For an account of an improved method of transferring the pattern from the original design to the Jacquard Loom.
169. For an economical means of producing figured patterns in the Loom by means of Electricity.
170. For a means of producing by the electrotype process a gilded pattern or portion of a pattern on textile fabrics, or of gilding the fibre previous to weaving.
171. For the successful application of some new means (as Electricity or Photography, for instance) for producing Ornamental Coloured Designs in Woven Fabrics, which shall be cheaper and easier of application than those at present employed.
172. For an account of the methods at present practised in France and Russia for dyeing and dressing Morocco Leather.
173. For an efficient means of removing the fatty matters from skins, so as to render them capable of receiving mordants by the ordinary printing process.
174. For a Negative Photographic Paper, uniform in texture, suitable for waxing, and of better quality than any at present in use.
175. For the best series of Tinted Writing and Packing Papers coloured in the pulp, made from materials not suited for the manufacture of white paper.
176. For the best method of Colouring Paper in the pulp with indigo, and with greens of various hues, the colours not to be liable to be affected by gases.
177. For improvements in the manufacture of Transparent Papers.
178. For the best method of Glazing Paper in the web.
179. For a method of more thoroughly Sizing Machine-made Papers with Animal size.
180. For an account of the processes at present used in the re-conversion of Woollen Rags, with specimens illustrative of the manufactures in which they are employed.
181. For an account of the methods and materials used in the manufacture of Waterproof Goods.
182. For an account of the machinery and processes used in cutting, working, and embossing Veneers, in imitation of carved work.

METALLIC, VITREOUS, AND CERAMIC MANUFACTURES.

183. For the best essay on Ancient Goldsmiths' Work.
184. For the best specimen of Ornamental Enamel on Metal.
185. For the best specimen of the Figure, worked either in Repoussé or by Chasing in Silver, out of the solid plate.
186. For an account of any new and improved processes for economically producing reflecting surfaces applicable to Lighthouses, or for general purposes.
187. For the best specimens of Cisterns suitable for household or other purposes, made of Glass in one piece.
188. For a cheap quality of Glass, applicable for drains, water-pipes, sinks, shelves for larders, dairies, &c., in which coarseness and want of transparency are not regarded.
189. For a new kind of thick Glass suitable for fixing in floors to light lower rooms, vaults, &c., which by the arrangement of its two surfaces will give the greatest amount of light.
190. For the best specimens of Glass for Chemical use, capable of resisting a high degree of heat without softening, and not liable to break from changes of temperature.
191. For an account of the processes employed in Chromatic Painting on Glass, Porcelain, Clay, Lava, and materials susceptible of vitrification, or capable of receiving an enamelled surface.
192. For a chemical means of Engraving on Glass and Crystals, avoiding the injurious effects of fluoric acid, and producing finely-detailed designs.
193. For some Chemical or Mechanical process for fixing or engraving the collodion photographic image on its plate of glass, so that it may be employed ornamentally in windows, &c., or as a matrix for obtaining impressions on paper.
194. For a new process for transferring to Porcelain, Photographic images which may be permanently fixed by being burnt in, and enamelled on the surface.
195. For any important improvement in the construction of Kilns for firing or baking Parian, China, and Earthenware, by which smoke is consumed or fuel economised.
196. For an essay on the manufacture of Earthenware Pipes and Stone Ware in general, with an account of the improvements introduced in the construction of the Kilns used in burning such wares, by which the emission of black smoke has been prevented.
197. For an account of the various Artificial Stones and Terra-Cottas introduced and employed for purposes of construction, stating their properties, advantages, and imperfections, and their relative cost as manufactured, both inclusive and exclusive of loss by breakage in the kiln.
198. For an essay on the various Concretes, Cements, Hydraulic Mortars, and Lutings for Pipes, Tanks, &c.

MISCELLANEOUS MANUFACTURES.

199. For an essay on Architectural and Decorative Ornaments; the materials employed, their mode of manufacture, and the comparative cost of production.
200. For a Composition for Feeding-Rollers for Printing Paper Hangings by cylinder machinery, similar in consistency and texture to the gelatine rollers used in letter-press printing, but adapted for working in water-colours.
201. For the best form of Kiln for the manufacture of draining tiles, hollow bricks, roof tiles, paving tiles, or common bricks; which Kiln shall be the cheapest and simplest to construct, with the least quantity of materials for transport, shall consume the smallest quantity, and effect the most perfect combustion of fuel, with or without means of drying in the Kiln itself or in a shed attached to it: to be verified by trial works and the cheapest production of perfect goods.
202. For an account of the methods of Distilling Coal or Bituminous Substances, and utilizing the residuum.
203. For the best means of preventing salt efflorescences on walls.
204. For any improvements and extensions of the processes known as "Nature Printing," to be accompanied by specimens.
205. For an Elastic Material for Tubing suited to the conveyance of Gas, and not liable to be affected by alterations in temperature, or to be acted upon by the gas itself.
206. For a ready means of Extracting Grease Stains from the finished surfaces of leather goods of a light colour.

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207. For an Essay on the Arterial Drainage of Land, considered with reference to the geological strata of the districts to be drained, with suggestions for such improvements in the main and subordinate outfalls of the country as are rendered desirable by the more rapid accumulation of surface water, caused by the increase of under-draining.

208. For the best method of economically deodorising sewage and other waters, and of precipitating or otherwise extracting the matters held by them in solution or suspension.

209. For the best method of separating (and preserving) Ammonia and its compounds, from sewage waters and refuse matters, for agricultural purposes.

210. For the best method of converting precipitated or extracted Sewage Matter into a dry or available state, for agricultural purposes.

211. For the best method of enriching the solid matters obtained from Sewage Waters, either by mixing the same with other salts, or manures in which the solid sewage matter is deficient, so as to adapt it to various agricultural crops; or, by facilitating its decomposition, to render any latent fertilizing ingredients it may contain, more readily fit for the food of plants.

212. For an essay on the management and maintenance of public roads, with special reference to their altered position, since the introduction of railways.

213. For an account of the rise and progress of any one of the principal Shipping Ports of the United Kingdom, and the influence of railways and steam transport upon its commerce.

214. For the best treatise on the Commercial Products of the Islands of the Eastern Archipelago, and their facilities and openings for trade.

215. For an account of the Linen Trade of the United Kingdom.

216. For an essay on the various branches of Industry which are known to be unhealthy, pointing out the causes of their injurious effects, with suggestions for prevention or relief.

NOTICE.

The Society is willing to receive communications on subjects not included in the foregoing list, but in all cases expressly reserves the power of rewarding any communication according to its merit, or of withholding the Premium altogether.

All communications must be written on foolscap paper, on one side only, with an inch and a quarter margin. They must be accompanied by such drawings, models, or specimens as may be necessary to illustrate the subject. The drawings should be on a sufficiently large scale to be seen from a distance when suspended on the walls of a meeting-room.

In regard to Colonial Produce of all kinds, it is absolutely necessary that a certificate from the Governor, or other qualified person, should accompany the samples sent to the Society, certifying that they really are the produce of the particular district referred to. The samples should be sufficient in quantity to enable experiments to be made, and an opinion to be formed of their quality; and it is desirable that the cost price in the district from which they are forwarded should be given. In every instance the maximum extent of the plantation from which the produce has been taken should be stated, with the average yield obtained, and whether similar articles have hitherto been exported from the Colony, or not, and in what quantities.

All communications and articles intended for competition must be delivered to the Secretary, at the Society's house, free of expense, on or before the 31st of March. This restriction, as to the date of receipt, does not apply to articles of Colonial produce.

Any communication, or paper read at an ordinary meeting, will be considered as the property of the Society. Should the Council delay its publication beyond twelve months after the date of reading, the Author will be permitted to take a copy of the same, and to publish it in any way he thinks fit.

Unrewarded communications and articles must be applied for at the close of the Session, between the third Wednesday in June and the last Wednesday in July, after which the Society will be no longer responsible for their return.

By order,
P. LE NEVE FOSTER,
Secretary.

BESSEMER IRON.

The following is an account of experiments on this process, made under the superintendence of Messrs. Smith, Phillips, and Co., the owners of the Dafen Tin Plate Works, Llanelly, who, at the request of the Secretary, have forwarded specimens to the Society's house, for the inspection of any persons interested in the subject.

In the first place, the firm furnished Mr. Bessemer with a mixture of different sorts of pig iron, such as are used by them for making their best charcoal bars. This was melted in the presence of one of the firm at Baxter House, and then run into the converting vessel, and in twenty-five minutes an ingot of soft malleable iron, ten inches square, was produced. It was so soft as, when cut with a chisel, to have almost the appearance of lead. The charge of iron being insufficient to fill the mould, a thin crust was formed at the upper end of it, and so strong was it that it required considerable exertion with a heavy sledge hammer before a small piece, about an eighth to a quarter of an inch thick, could be broken off. The ten-inch ingot being too large to be treated properly there, Mr. Bessemer had it hammered down at Woolwich into two ingots of about four and five inches square. It was evidently injured by this process, having been apparently overheated, for the two ingots broke easier than ordinary pig iron of the same size would do. This was very discouraging, but the firm determined to continue the trial. They began by heating part of an ingot in a hollow fire, and when it was at a white heat, it was reduced under a 30-hundredweight steam hammer to a slab, about five inches wide by three inches thick. This was again heated and rolled into a bar, half an inch thick, and a very wretched-looking bar it is stated to have been, being deeply cracked all down one side. Much better bars have, however, since been made from part of the *same* ingot. So bad was it, that one of the firm thought it useless to proceed further with the experiment; but another member, nothing daunted, had it cut up into pieces of the usual length, and taken to the mill. It proved to be what is called in the trade very cold short, and did not cut at all well. Here, however, the difficulties ended, for it rolled beautifully into sheets, to the amazement of all who were present. The thinnest of the specimens sent (all of which were made from the unpromising looking bar above mentioned) is what is called "tagger" iron, and is unusually thin. At all events, none so thin have ever before been produced there, or at all approaching to it. It will be found, on bending it, that it is remarkably tough. The thicker piece of iron of the specimens sent has not been annealed, and therefore is not so tough; but the same iron, annealed and finished as tin plate, stands what is considered a very severe test, namely, twice doubling without cracking. The firm have reason to believe it is fully equal to plates of the same substance made from their best charcoal iron.

This experiment, and others since made, lead to the belief that, if uniform results can be obtained from the converting vessel, and if the same quality pig iron is always used, there is every reason to believe that the invention will prove very valuable to tin plate makers, as there is clear proof that sheet iron of superior quality may be produced by adopting it.

The best way of working the large ingots into bars has yet to be learnt; but it is expected that the plan Mr. Bessemer recommends, of passing them through a series of rolls, will be found to answer perfectly. It may be mentioned that Messrs. Smith, Phillips, and Co. tried a piece of the bar from which the specimens sent were rolled, in the blacksmith's shop. It proved to be very red short, and difficult to work; so that some further improvement in the process is required before iron made by it can be brought into general use.

NEW PROCESS FOR THE MANUFACTURE OF STEEL.

For the satisfaction of a number of scientific gentlemen, engineers, and others interested in the subject, an exhibition of the new method of manufacturing steel, the discovery of Capt. Uchatius (Engineer in Chief of the Imperial Arsenal at Vienna), was made on Saturday last, at Messrs. Rennie and Sons, the Albion Engine Works, Holland-street, Blackfriars-road, in the presence of numerous spectators.

Mr. Charles Lenz, the partner of Capt. Uchatius, operated on the occasion, assisted by workmen from the factory of Messrs. Turton and Co., at Sheffield. Whilst the process was going on, Mr. Lenz read a paper descriptive of the invention. He commenced by explaining that he had laboured under many disadvantages in being compelled to contrive substitutes for the regular furnaces and other proper appliances peculiar to steel works, but, nevertheless, an opinion could be there formed of the merits of this important invention, for all the melting operations in cast steel manufacture were necessarily a series of operations on a small scale, the size of a steel crucible limiting the magnitude of the furnaces. He proceeded to state that the method adopted in England, and all over the world, he might say, for making the best descriptions of cast steel heretofore, was to convert Swedish or Russian bar iron, by a lengthy, uncertain, and costly process, first into what is called blister steel, which product was then melted down in crucibles and cast into ingots for the manufacture of the bar steel of commerce. The invention about to be exhibited by him would render this country quite independent of Sweden and Russia for steel iron-making, as he would show the company present that East India pig iron, now very plentiful and cheap here, could be converted into fine steel in as few hours as Swedish and Russian bar iron would take weeks to manipulate; in addition to which, he could assure those present that numerous descriptions of ordinary English pig iron would answer for this process equally well, if he might judge from the limited experiments in English iron he had performed. Indeed, the results of these experiments were very remarkable, and he expected that nearly all the ironworks would soon make steel as regularly as they now made iron. He begged the company to consider the importance of a discovery which would so reduce the cost of steel as to render it available for numerous purposes in engineering, now quite precluded by the price; he did not hesitate to assert that fully two-thirds might be saved in the cost of producing cast steel by using the present instead of the old process. Mr. Lenz then proceeded to explain that the invention of Capt. Uchatius was founded upon the well-known fact that cast iron surrounded by any oxygenised materials, and subjected to a cementing heat for a given time, would yield up a portion of its carbon, which would combine with the oxygen driven off from the surrounding materials, forming carbonic oxide or carbonic acid gas. If this process were interrupted before completion, a partially decarbonised iron would result, the surface of which would have been converted into a pure iron, while the inner parts remained unchanged; or, in other words, the progress of the decarbonising action would depend on the amount of metallic surface brought into contact with the oxygen-yielding material with which the iron was surrounded. In order, therefore, to expedite this operation, the pig iron was first reduced to a granulated state, which was accomplished by simply running the molten iron from the cupola (a blast furnace in some cases) into cold water, agitated by mechanical means. This granulated iron was mixed with a proper proportion of pulverised oxygen-yielding materials of a very cheap description, such as sparry iron ore (spathose ore), and adding, if requisite, a small quantity of manganese, which mixture was put into common crucibles and subjected to heat in a cast-steel blast furnace of ordinary construction. By thus subjecting the granules of iron, in presence of the sparry iron ore, to a melting heat, the surrounding oxides would first effect a partial decarbonisation of the granulated iron, which decarbonisation would be limited in amount according to the size of the granules operated upon, and by reason of the continued application of heat the iron would melt and separate (with the assistance of the melting residue of sparry iron ore) from the impurities with which it was mixed, and also bring down with it a portion of the iron contained in the sparry iron ore, thereby increasing the yield of cast-steel by about 6 per cent. The manipulations of melting and casting were the same as those commonly employed by cast-steel manufacturers. The quality of the steel made by this process could be considerably modified. Thus, the finer the pig iron was granulated, the softer would be the steel made therefrom. The softer sorts of welding cast-steel might be obtained by an addition of good wrought iron in small pieces, and the harder qualities by adding charcoal in various proportions to the before-mentioned mixture. Thus, continued Mr. Lenz, might crude iron be converted into steel ingots in the incredibly short space of about two hours.

Mr. Lenz then proceeded to exhibit the preliminary process of granulating, by running a crucible of melted pig iron into a vessel of water, when it was instantaneously converted into shot-like particles. A weight of 24lb. of the granulated iron was mixed with six pounds of crushed ore and peroxide of manganese, in the proportion, it was said, of about 4lbs. of ore and 2lbs. of peroxide of manganese, to which was added a small quantity of fire-clay, and filled into the crucible in the temporary furnace, and allowed to melt in the usual manner. In the mean time the company proceeded to witness the operation of the hammering down into a bar of an ingot of this new steel, which had been made a few days since, and although the steam-hammer used was not at all adapted for steel, nevertheless, the bar steel produced from the ingot then hammered was pronounced to be of excellent quality, and tools made by Messrs. Rennie from a fellow ingot were tried and found to possess the qualities of fine English cast steel. After two hours and three quarters had elapsed since the filling—some defect in the blast a little retarding the melting—the contents of the crucible were poured into the iron mould, from which, when opened, an ingot of steel, weighing 25lb., being 1lb. more than the iron used, was exhibited to the company, which bore every external evidence of being perfect in quality. It was to be forwarded to the steel works of Messrs. Spencer and Sons, of Newcastle-on-Tyne, to be properly tilted into bar steel for further tests as to its quality and properties. The simplicity and rapidity of the new process, as well as the quality of the specimens of steel shown, elicited much admiration. The importance of the process in reducing the cost of steel can scarcely be overrated when the innumerable new uses to which it would inevitably be turned in preference to iron are considered—the expense of steel tyres, axles, piston rods, shafts, and other important working parts of machinery being estimated as not exceeding the price now paid for first-class iron.

The gentlemen present on Saturday were—Messrs. Appold, C. Atherton, Engineer-in-chief Woolwich Dockyard, Anderson, Engineer-in-chief Woolwich Arsenal; W. B. Adams, Bachhoffner, Brown, of Ebbw Vale Ironworks; Beale, G. E. Cooper, Charles Cammell, D. Kinnear Clarke, Captain Edwards, H.E.I.C.S., Joshua Field, C.E., J. Freeman, Jos. Glynn, F.R.S., C. H. Gregory, C.E., Evan Hopkins, C.E., W. J. Hamilton, Harcott, Kitson, Kreeft, P. Le Neve Foster, Loyd Foster, T. Lloyd, Levick, H. Maudslay, C.E., Charles Manby, C.E., Charles May, C.E., F. Marriott, G. Morton, W. Needham, of Butterley Ironworks; Joseph Robinson, of Ebbw Vale and Coalbrook Dale Ironworks; Rennie, T. Spencer, Simpson, H. Turner, Walker, Weyte, of Woolwich Arsenal, &c.

The thanks of all present are due to Messrs. Rennie and Sons for their courtesy and liberality in thus affording the scientific world of London an opportunity of witnessing so interesting an experiment.

THE LATE JOHN WOOD, ESQ.

On Friday last died John Wood, Esq., Chairman of the Board of Inland Revenue. In him the Society has lost a warm friend, and one of the earliest promoters of the system of Examinations lately established for Students in Classes at Mechanics' Institutions. It will not be forgotten that, on the first promulgation of the Society's plans, he at once placed at the disposal of the Council two appointments in the Inland Revenue service, to be competed for at the annual examinations, and thus helped materially to secure the success which has attended the Society's exertions in this direction.

DEATH OF FRANCIS WHISHAW, ESQ.

The members of the Society will learn with regret the death of Francis Whishaw, Esq., formerly Secretary to this Society. It is to the zeal and energy of Mr. Whishaw that the Society stands indebted in a great measure for its resuscitation. He accepted the office of Secretary at a time when there were few members to support his exertions, and scarcely any funds with which to meet its expenditure. Owing to his continued personal efforts, backed by the advice and assistance of a few active members whom he gathered around him, he succeeded in instilling new life into the then all but expiring body. His labours to improve the character of the Society's evening meetings, the conversazioni he established, and the efforts he made to promote the formation of a National Exhibition of the Industries of Great Britain, brought around him a body of friends and members who, on his retiring from the office in 1845, elected him an Honorary Life Member of the Society. His death took place on the 6th instant, the immediate cause being an attack of apoplexy.

ART TREASURES EXHIBITION.

The brickwork for the façade of the building progresses steadily. The great central arch is nearly completed at the front; the centres are up for the picture galleries; and good deal of work has been completed behind. Already a decided advance has been made with the placing of the rows of pillars which mark the centre and side aisles of the great hall, and in the fixing of the girders upon them. When work is commenced at the opposite end, the daily progress will seem almost marvellous.

Four huge travelling scaffolds have been erected; and a great portion of the immense floor has been (temporarily) covered with deals, for the wheels of the scaffolds to run upon. The groundwork has long been completed. All the ironwork—including pillars, girders, arches, tie-rods, and casing sheets—has been finished at the works of the contractors, Messrs. C. D. Young and Co. at Glasgow and Edinburgh; a large proportion has been deposited upon the ground, and the remainder is on its way here, by rail. All the flooring boards, and the wood for lining the building internally, are upon the ground; and various arrangements are being completed for a vigorous start in fixing the ironwork. The fixing of the pillars and girders will be carried on from each end; the hoisting of the ribs for the arches and the laying of the flooring being carried on, so that all shall progress almost simultaneously, except the placing and rivetting (or bolting) of the external plates. No doubt of the completion of the building by the 1st of January is entertained by those who are responsible for such being done.

Colonial Correspondence.

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COLONIAL LABOUR.

Sir,—I observed in your last *Journal* a communication signed "Leonard Rowe Valpy," the writer of which says, that in my letter on Colonial Labour "there are one or two points on which I have fallen into error, and which he thinks require correction." If I have had the misfortune to "fall into error," I am very sorry for it, and I shall be happy to be corrected by Mr. Valpy or any one else. But there is nothing more facile than accusation of error, and it is easier to contradict than to disprove. Now, Mr. Valpy's "correction," as he is pleased to call it, amounts to nothing more than a broad denial of the truth of my statements, and he seems to think that his simple assertion is sufficient to convict me of error. As I am not disposed to recognise in Mr. Valpy an indisputable authority on colonial questions, I should require something more than his mere word. Of course Mr. Valpy, like any other gentleman, would not make any statement which he knew to be at variance with truth. But Mr. Valpy is human, and, therefore, as liable to "fall into error" as the humble individual now addressing you. Mr. Valpy says, that "my local knowledge entitles me to the credit of authority" in matters connected with Honduras, but in Jamaica, "he has resided for several years," and, therefore, on the affairs of that island he claims to be oracular. It has not been my good or evil fortune to reside for many years in that highly favoured colony, but I have at sundry times conversed with gentlemen whose residence had been much longer than Mr. Valpy's, and whose pretensions to intelligence and knowledge were as strong as his. Other sources of information, in the shape of blue books, despatches and returns, have also been as open to me, and to all the world, as to Mr. Valpy.

But what are the errors into which I have fallen, and which call for Mr. Valpy's correcting hand? In endeavouring partly to account for the scarcity of colonial labour I mention, amongst other causes, first the tone of mind which took possession of the negro immediately after the cessation of slavery, and secondly, the imprudent distribution of small lots of land amongst the African race. I also stated, as a probable prospective cause of the further diminution of the labouring class, the system of education which many most estimable, intelligent, and praiseworthy persons are desirous of introducing into the Colonies. And what does Mr. Valpy say? "It is true that on attaining freedom the negro was unfitted for continued industry." Precisely what I say. "Again it is true that by the sale of waste mountain lands in a few of the islands the negroes were withdrawn from the plantations." I say pretty nearly the same thing, but I respectfully deny that they were *waste* mountain lands. In using the words "a few of the islands," Mr. Valpy of course intends to include Jamaica, for he afterwards says, "I profess not, however, to pass even an opinion as relating to any other colony than Jamaica." Again he writes: "I agree with Mr. Temple as to the degree of education required." These are Mr. Valpy's own words. In reality, then, he does not differ from me as to the broad facts. I say that when slavery ceased to exist, the negro would not at first engage in continuous work. Mr. Valpy says the same. I say that by the sale of land to the negro he was withdrawn from the labour market. Mr. Valpy says the same. I mention a system of education which I think is most fitted for the children of the negro population. Mr. Valpy says he agrees with me.

Mr. Valpy says, "Mr. Temple shall once more correct himself; alluding in another portion of his communication to the habits of the negroes, he says: 'If they have land of their own they *will not* cultivate it to any useful purpose. A few yams, &c., are all that they will grow, and for these little or no labour is required.' Had the feeling above mentioned been the guiding impulse of the small freeholder, there would have been no cause to complain of the result. It is the wasteful system of temporary squatting which causes so much evil to all sections of society." I do not quite comprehend what Mr. Valpy means by "the feeling above mentioned being the guiding impulse." But passing that over, does he mean seriously to state as his opinion that dividing the land into small lots, and granting them to the negro, are productive of results "of which there is no cause to complain?" Temporary squatting is doubtless mischievous in its effects. It promotes an idle and roving disposition, and it injures the land by a careless and unskilful cultivation. But you have the remedy in your own hand. You can put the law in operation, and stop it at once if you think proper. But the permanent and rightful occupation of small lots of land is productive of evils which cannot be remedied. If Mr. Valpy were to turn his tenant Farmer Flamborough out of the land which he cultivates so well, and the rent of which he regularly pays on every quarter day, and divide it into a hundred or more small parcels, and let each of them to a day labourer, the land would not be properly cultivated, and Mr. Valpy would never see a stiver of his rent. Instead of the goodly crop of wheat, and oats, and barley, which the farm now produces, and which the said Mr. Flamborough turns to a very satisfactory account, one lot would be sown with potatoes, another with turnips, in another there would be cabbages, and in another perhaps there would be nothing at all. Scarcely a tenant would get such a return for his produce as would enable him to pay his rent, and keep his wife and family from the parish. Then, again, for want of intelligence and money, the land would be ruined by a vicious cultivation.

Mr. Valpy says, "I agree with Mr. Temple as to the degree of education required; but I cannot think it necessary to join in his remonstrance against the *evil* of *cramming* [the word is not mine] the negro mind 'with metaphysics and logic, history and astronomy, Latin and Greek, the niceties of grammar, and the subtleties of style.'" The above sentence is not very easy to understand. If Mr. Valpy agree with me as to the degree of education required, he *must* join with me in my remonstrance, and if "cramming" be an "*evil*"—he cannot defend it. But it appears that Mr. Valpy *would* "cram" the negro mind with Latin and Greek, &c. If that be his "peculiar vanity" I have nothing more to say. He has a perfect right to indulge in it. Hercules performed twelve labours, for which, and other acts of virtue, he was rewarded by being made a god. Simeon Stylites stood for thirty-seven years on the top of a high column, for which meritorious achievement he was very properly compensated by being admitted a member of the College of Saints. But what adequate reward can be given to that deserving person who shall succeed in "cramming" the negro mind with Latin and Greek.

Mr. Valpy says, "His local knowledge entitles him to the credit of authority when he points to the 80,000 Indians in question. If it be true that these people would be glad to escape from their oppressors, I should have thought such a supply amply sufficient for some years to come." So should I. But in a population of 80,000 how many women and children are there, does Mr. Valpy suppose? How many sick and infirm? And how many are there who are inveterately idle, and who cannot be got to work for love or money? Making all necessary deductions from the 80,000, I shall only get about 5,000 able-bodied and industrious labourers.

Mr. Valpy quotes, but whether to support his views or mine it is difficult to say, a letter published in a Jamaica newspaper, and signed with the initials "W. W. A." The writer of the letter is, I presume, Mr. Anderson, a highly respectable attorney of Spanish-town. I do not know that I should be disposed to adopt, without qualification, his opinion respecting colonial affairs, although I entertain for him personally a great respect, for he is a very worthy and intelligent man. But let us hear what he says in the letter quoted by Mr. Valpy:—

"How to procure labour for the profitable working of his large fixed capital, has long been the all-absorbing question of the proprietor, and no progress has yet been made towards the solution of it. Meanwhile ruin is creeping like a leprosy over our future. Several elements enter into the labour question which have not yet had that attention which is essential to the attainment of just practical conclusions upon it. The condition out of which we have emerged had laws of its own, and gave form and body to a condition of the society which prohibited the advancement of the labouring classes, although these formed the numerical majority. The course of the old economy was to concentrate on single plantations bodies of labourers as large as the landholder's purse could procure, and according to the extent to which he was enabled effectually to cultivate the lands immediately surrounding his building and machinery, so were his profits. In a state of freedom, these considerations must in a great measure be reversed. When the quondam slaves have thoroughly understood their new position, all considerations affecting the capitalist will be lost in the consideration of what is personal to themselves. *He* is no longer the lord of *their* movements, nor *they* the creatures of *his* will, so that motives must be presented to induce them to labour for him at such times and places as *he* shall prescribe, instead of for themselves at such time and places as *they* shall please. This is the true complexion and relative position of capital and labour in this and all other free countries, with which, therefore, we must deal. . . . Hundreds of coffee and sugar plantations have been given up; the labourers disengaged were free to do as they pleased. And what did they please? *Not to go to the remaining plantations, but to turn to on their own account.* Hence the anomaly of a cry of "no labour in the country," at the moment of tens of thousands of men being thrown loose from all engagements."

It really appears to me that these are nearly the identical sentiments which I myself enunciated in the letter which has called forth Mr. Valpy's "correction." I say—"There can be no question that the tone of mind which ensued when the shackles of bondage were struck off did for a long time, and does now to a very considerable extent, render extremely difficult the employment of labourers *in* the colonies. . . . As a last resource, and to keep their heads above water from day to day, thev disposed of their lands, bit by bit, to those very negroes, &c. . . . What negro could be induced to labour for another who had an acre or two of land to cultivate for himself. . . . He was free—aye, as free as the white man, his former lord. He would not labour as a serf—why should he?"

Mr. Valpy is not pleased that "the proposed new colony of Honduras should draw a further supply of labour from its prostrate sister colonies." Surely I have a right to go to the cheapest market—wheresoever that market may be—for labour as well as for any other commodity. If I offer to labourers in Jamaica higher wages than they are at present getting, it is a legitimate transaction, and Mr. Valpy is not justified in accusing me of "*enticing* the negro population from the island." I do not go surreptitiously and covertly to work—I proceed openly and publicly. I do not attempt to seduce labourers from their employers, but I find them disengaged, and I offer them good wages and cash payments. Would Mr. Valpy scruple to go to Ireland for reapers, if he could get them cheaper there than in England? He may depend upon it that the "finest pisantry of the worrold" will not leave their pigs and potatoe fields if they can get employment and good wages in their own country. He says, "if any scheme be set on foot for that purpose he warns the parties of a complete failure." And why? Because "the Jamaica people have spent hundreds of thousands of pounds in immigration, and hundreds of thousands of labourers are still required." This sounds very like a *non sequitur*. It is our stage-coach companion and the fleas over again. Granted that they *have* spent hundreds of thousands of pounds in immigration, where do we see the fruits of that expenditure? An "echo answers, where?" But what does Mr. Anderson say upon this subject, in the letter which Mr. Valpy quotes?

"This scheme (immigration) has involved the island in a large amount of debt, without apparently having made the desired impression on the labour market; *and been accompanied by an appalling amount of suffering, destitution, and mortality*."

How can the fact of their having spent so much money render the scheme a complete failure? On the contrary, it is more likely to make it successful. If they have before spent so many thousands of pounds, and "involved the island in a large amount of debt" by so doing, they have the less to spend now. If Mr. Valpy had said the scheme would be a failure, because there was a great demand for labour in Jamaica, and if higher wages were offered than what were now paid, the proprietors in that island, having plenty of capital, would bid higher still—I should certainly have agreed with him.

But why should Mr. Valpy call Jamaica and other islands "prostrate colonies"? They are not prostrate. Many of the proprietors may be ruined, the production of sugar and rum may have ceased to be as profitable as heretofore, capital may have fled, energy may be extinct, the people may neglect their substantial interests to engage in political squabbles and angry discussions, but the countries themselves are very far from being prostrate.

Mr. Valpy says, "Mr. Temple, together with many others, advocates immigration of unskilled labour, involving a mixture of races, and the importation of every variety of heathenism." Of course I do. I advocate the introduction of as much heathenism as possible. I prefer it. Rest assured that the heathen will not Paganise the Christian, but the Christian will convert the heathen. "For the unbelieving husband shall be sanctified by the wife, and the unbelieving wife shall be sanctified by the husband." I say, by all means let us have every variety of heathens. Let us instruct their minds; let us teach them the great and glorious truths of Christianity; let us initiate them in the true liberty of the cross; and then, with the Bible in their hands and Christian love in their hearts, let us send them to their own country to preach to their benighted brethren. That "large class" of whom Mr. Valpy speaks, "who advocate another view, and seek to arrest the influx of such an accumulation of ignorance and vice," are selfish and short-sighted. They are like a timid physician, who hesitates to feel his patient's pulse, lest he should catch his disorder. I have no symyathy with them. But I accord with those who boldly encounter the foe—and like the courageous Sydenham, who, when the plague was raging in London, placed himself in the midst of the encampment to challenge and do battle with the pestilence. Respecting the religion of the Indian immigrants, Mr. Hill, stipendiary justice of peace, and acting-agent-general of immigration, thus writes: "There is little doubt that something might be done to place these denominations of immigrants in a better condition, both socially and with respect to Christian progression, than is at present within their reach. Few persons are so inquiring as to acquaint themselves with the fact that *there are any but inveterate heathens or irreclaimable Mahommedans among the Indian immigrants*."

Mr. Valpy says, that, in speaking of the Coolies, who were brought to Jamaica, I have made "misstatements" and "unfounded assertions." This is a serious charge, and I think Mr. Valpy would have done well if he had abstained from giving expression to such unmitigated terms. Now I humbly conceive that I made no statements, nor assertions, the correctness of which I am not in a position to prove. I said that the Coolies had not been over *well* treated in Jamaica, and that they were thrown on their own resources in a strange country. To that statement I adhere. With respect to those unfortunate creatures much blame is attributable on all sides. In the first place, there can be no doubt that too little care was bestowed in the selection of them, especially those who were brought from Madras. Instead of hiring only able-bodied and industrious men, who had been used to agricultural operations, many idle persons were engaged who were quite unaccustomed to that species of labour, and who were beggars and vagabonds in their own country. In the second place, in addition to the wages, &c., of the Coolies, the proprietors, now reduced to great pecuniary distress, were required to pay a tax for every labourer they employed, and if they hired any without the consent of the Governor they were subjected to a penalty. This regulation unquestionably prevented many Coolies from being employed. Several proprietors and managers who did employ the Coolies upon their estates were not kind and conciliatory to them, refused to humour their oriental prejudices, were careless about their personal habits, and neglected to provide for them any religions or moral instruction. In consequence of the treatment they received, great numbers deserted from the plantations on which they were engaged, and in company with those who, partly on account of the tax, partly on account of prejudices against the eastern strangers, and partly on account of pecuniary inability, were not employed at all, wandered about the country in a state of the most abject misery and destitution. But this was not all. The poor wretches, almost in a state of nudity, suffering from chigoes, covered with sores, a mass of filth and abomination, without food to eat, without a shelter under which to lie, were not classed with the native poor, and for a considerable time were denied parish relief. It was only after the urgent solicitations of Sir C. Grey that a very scanty assistance was afforded to a few. Sir C. Grey, in a despatch, dated 6th March, 1848, addressed to Earl Grey, speaking of the Coolies, says:—

"The repeal of the law which subjected all persons to a tax who employed them for however short a time, and to a penalty, if it was done without the leave of the Governor, will gradually give employment to many, *who must otherwise have gone without it;* for the distressed condition of the sugar planters has made several of them comparatively indifferent whether, during the spring, they obtain labourers or not; and in divers instances those who have had gangs of Madras Coolies have positively refused, on the expiration of the contract, to renew it, unless upon inadmissible conditions, such as not being obliged to find medical assistance, &c. There has been a great deal of vagrancy and begging, much misery, and, I am afraid, some cases even of death from destitution and its consequences. It is not easy, when the Legislature is not in session, and in the present dissatisfied state of the colony, to devise the means of giving any extensive relief; but I have made it generally known, and it has not excited any opposition, that the laws of vagrancy are applicable to the Coolies, and that destitution entitles them to parochial relief like the other poor; and I urge upon the Agent-General and his subordinate agents the necessity of paying constant attention to the claims and condition of these people."

There can be little doubt that, if there had been no impediments to the employment of the Coolies, and if those who were employed had been kindly and judiciously treated, the Indian immigrants would, upon the whole, have been valuable labourers.

This was proved by the fact, that those who *were* well treated did *not* desert from the plantations on which they were engaged, but gave the greatest satisfaction in every respect to their employers. Mr. Hill writes, "Though unfitted for the heavier species of field work, they have been found useful auxiliaries to the more robust negro in every department of cultivation which requires *care, diligence, and perseverance.* In weeding and planting, in hoeing and thrashing, *they are more to be depended on for faithful work than the African,* and they really fill most desirably a middle place in the field economy of plantation. The testimony of so valuable a witness as Mr. Roberts to the orderly and economic habits of the Coolies, in their leisure and retirement after labour, is no unimportant addition to the several approving communications laid before the House of Assembly lately in session." In answer to a circular issued by Mr. Hill, inquiring into the causes of vagrancy and desertion, Mr. George Ashby, of Amity Hall, says, "I am happy to say there are no Coolies deserted from this estate." Mr. Thomas Heath, of Danks, says, "They all appear to be happy, and attend to their work regularly, and most of them have a provision ground of their own. Indeed, it is my firm belief that the estate could not be carried on without them."

Mr. Rose, of Pennant's Estate, writes—"The coolies on this estate (*both Calcutta and Madras*) have been very steady, and not more than five or six days' labour of one coolie has been lost by absence from the estate since their arrival on it."

Mr. A. J. Lindo, a proprietor, of Friendship Estate, Port Maria, St. Mary, writes—"I have had 15 Madras coolies located on this estate since May last. There has been no desertion or vagrancy of any of them; their conduct is generally good, and with the exception of slight intermittent fever, they have been healthy. I have to regret that I have not twice the number, *as I am of opinion that were proper care taken of the people, desertion and vagrancy would not be of common occurrence, and that they would be a useful acquisition to estates.*"

Mr. William Duncan, of Parnassus Estate, Clanadon, writes—"I beg to state that occasionally the coolies give some trouble, *which I overcome by kind treatment,* and determination in enforcing the due performance of their contract; none have left the estate to wander about the country. They are now looking well and working regularly."

The above testimonials of the value of the coolies as labourers, when properly treated, are a sample of a very great number to a like effect which were sent in reply to the circular; but there were also some of an opposite character. Take the following as a specimen:—

Petersfield Estate, Westmoreland, Dec. 8, 1847.

SIR,—In reply to your circular of the 4th instant, addressed to the overseer of this estate, I have the honour to inform you that I have never given in my name for Coolies, that it is only within this last month *that I had the misfortune to come in contact with such disgusting, filthy creatures.* I should suppose the cause of vagrancy to arise here from their long confirmed habits of vagrancy in their own country; the cause of desertion, their loving vagrancy better than work. It appears to me that all interested in the preservation of common decency should deem their desertion from the island a great blessing." Such letters as the above require no observation. The following remarks are made by Mr. Emery, Stipendiary magistrate, and sub-agent of immigration:—"In Hanover, however, it is true, the spirit of desertion and vagrancy has all along shown itself to exist to a most powerful and disgusting degree. I attribute this sad state of things to the culpable apathy and indifference of the authorities of Lucea, who, instead of exercising that wholesome authority with which they were vested for the public advantage, actually held, and hold, out encouragement to the wandering gangs, by directing the police force not on any account to interfere with the people's liberty, and permitting them to accumulate in hordes, and sleep in the under part of the Court-house nightly, a horrid spectacle of filth and nakedness, a bright example of unbridled vagabondage and misery for the more depraved of our own peasantry to emulate them in. In conjunction with the inactivity of the magistracy, and the absence of all interference on the part of the police force, (which reduced as it is to a mere handful of men for each parish, is of little or no use at all), with the wandering Coolies, whose desertion and vagrancy has called forth this inquiry by the Hon. House of Assembly, with a view to apply (as I trust) some prompt remedy to so great an evil, I should imperfectly perform my task if I left unaccused many managers of properties, of very great blame, by inattention, carelessness, and in some instances utter recklessness, of the health, cleanliness, and comfort of the poor people placed under their care and charge, the more especially when in sickness, because they so unequivocally and expressly show their great confidence in, and full expectation of receiving at such hands that treatment as exacted from employers by the terms of their contract, and irrespective of which they conceive the common feelings of humanity should prompt them to exercise. I say emphatically that a heavy load of moral guilt attaches to many managers on this score, for *dissatisfaction has not unnaturally been engendered by such treatment, the continuance of which unimproved in any shape, has led to the result now manifesting throughout the island.*"

Mr. W. A. Bell, of St. Dorothy, sub-agent of immigration, thus writes: "I conceive the reasons to be various and combined which have led many of the Indian immigrants to desert from time to time the properties on which they have been employed. The difference of management amongst the overseers must be a cause of desertion or non-desertion; some are most conciliatory, kind, firm, sensible, and really appear to wish the people, as immigrants, to do well for themselves and the property, and seem to succeed invariably. Others again give a nurse for the sick, and other necessaries, food, &c., and comply with the words of the agreement; but, from an aversion to any immigrants excepting negroes (the attornies having placed these Indians under them), or from idleness, pay no further attention to them, neither encourage nor conciliate. If they work, pay them, if not, leave them alone. These overseers do not succeed, neither do the immigrants. It has been the custom to consider that when a planter becomes an overseer, he should know his business; it must, therefore, have been distasteful to many to have labourers given to them whose language, habits, and peculiar management they were totally unacquainted with; and as they were made answerable for the amount of labour, with reference to the pay bill of the week, it may account for some difference in the numbers absent at times from the property's field."

I think I have now brought forward sufficient evidence to prove that I made no "unfounded assertion," and that I was not guilty of a "mis-statement" when I said that the Indian Coolies in Jamaica had not been *over well* treated, and that they had been left to their own resources. But Mr. Valpy also denies the correctness of my statements with respect to the Chinese labourers. I say that they are very intelligent, and on that account have been preferred in Cuba to the negro. Mr. Valpy says, "The vagrant Chinese are utterly helpless, having defied the efforts of the Agent-General of Emigration, and of their own leading countrymen, to settle them in a plantation for the cultivation of rice or ground nuts." It is quite possible that the Chinese—and for the same reasons, perhaps—did not succeed in Jamaica any better than the Coolies. But they were more fortunate in British Guiana and Trinidad. Sir Harry Barkly, in a despatch, dated the 26th February, 1853, addressed to the Duke of Newcastle, thus gives his valuable testimony as to the efficiency of Chinese labourers.

"With respect to the remaining point, their efficiency in labour, it might almost suffice to say that the six set to break stones within the jail, accomplish a far greater amount of work in the allotted hours than has ever previously been got out of either negroes, Portuguese, or Coolies; but I can also bear testimony to the general approbation expressed of them as labourers in sugar cultivation by all the planters who have yet had to do with them, corroborated by the material fact of the large earnings to which they had entitled themselves in addition to their keep."

Lord Harris, in a despatch dated 22nd March, 1853, addressed to the Duke of Newcastle, says:—"The planters are highly pleased with the Chinamen, and universally consider them far superior to any labourers they have ever received, and it will be most unfortunate if any discontent should arise from circumstances over which we, in this colony, had no control."

I have got an abundance of evidence yet to bring forward, were it necessary, to prove the almost universal good opinion entertained of the Chinese as labourers. But I think I have said quite enough to satisfy you that I have not been guilty of "misstatements" and "unfounded assertions."

I am, &c.,
R. TEMPLE.

25, Bernard-street, Russell-square.

Home Correspondence.

RESISTING POWER OF IRON.

Sir,—In the *Journal of the Society of Arts* of the 19th ult., Mr. Bridges Adams, in his valuable letter on the Bessemer iron, proposed a series of experiments to be made by Government, but none of them have any reference to the power of an iron navigable vessel to resist shot. This question is, however, of vast importance, as well to the mercantile as to the military marine, for, should a merchantman be assailed by the enemy, she would immediately strike if not able to do so. The series of experiments to ascertain this should embrace, 1st, the thickness of plate of iron which would best resist penetration of shot; 2nd, the danger to a ship's crew that would ensue from splinters; 3rd, the obliquity with which the shot strikes; 4th the means of stopping shot holes; and these must all be ascertained when afloat as well as on a fixed butt on shore, since the recoil of a vessel on water, however slight, may be sufficient to prevent injury.

The experiments hitherto made in this country have only been on a fixed butt. The naval officers who gave their evidence to the Committee of Finance, in the year 1848, were of opinion that iron vessels could resist shot, but Mr. Fairbain decidedly told me that the experiments made at Woolwich were adverse to this statement.

I am, Sir, yours truly,
M. S. BENTHAM.

26, Wilton-place, October 6th.

NEGATIVE ARTESIAN WELLS.

Sir,—Mr. G. Bailey Denton has, in No. 196, p. 688, of your *Journal*, endeavoured to ridicule the term "negative," which I use in my treatise on "Negative Artesian Wells, or Absorbing Bored Wells," in Nos. 192—195 of the same *Journal*. Mr. Denton is probably not aware that the late celebrated M. Arago was the first who applied the word "negative" in connexion with Artesian Wells, in the *Annuaire* for the year 1835, p. 243 (Paris, 1834), where he says:—

"Les trous par lesquels se jettent dans les entrailles de la terre, des nappes d'eau qui, faute de ce moyen d'écoulement, séjourneraient à la surface, pourraient en quelque sorte être appelés *des fontaines artésiennes négatives*, &c.," and from that time the term has been adopted, and is well *understood* on the Continent.

That Negative Artesian Wells should only be executed where there is no natural outfall, or any great difficulty in establishing one, is a matter of course, and this must be apparent to any one reading only the first page of my treatise, where I say:—"*Which* (water), *for want of a fall in the ground could not be drained in the common way.*"

The practice to which Mr. Denton alludes, of establishing such sumps (sumphs) or swallow holes, which are not able to carry off the drainage water entirely and under all circumstances, *appears* not only, but *is*, open to objection, and I myself reject such a procedure as faulty and wanting all claim to the title of a skilful engineering operation. Those who read my treatise attentively must be convinced of this.

I am, &c.,
A. E. BRUCKMANN,
Consulting Engineer and Geologist.

26, Upper North-street, Brighton, October 13, 1856.

Proceedings of Institutions.

Alton.—The 19th annual report of the Mechanics' Institution congratulates the members upon its increasing efficiency, there being 90 annual and 148 quarterly subscribers. Several lectures have been delivered during the past year, which have been generally well attended, and during the ensuing winter they are likely to be more numerous than usual. The committee are anticipating the services of the following gentlemen, but their subjects are not at present fixed, viz.—the Hon. and Rev. S. Best, the Rev. F. M. Cunningham, the Rev. G. D. Snow, Dr. Burnett, L. Leslie, Esq., and Mr. Stewart. Besides these, Dr. Curtis intends to give five or six lectures on physiology; Mr. A. C. Crowley, two on the Manners, Customs, &c., of the Ancient Egyptians; and Mr. F. Crowley, one on Heat; all of which will be copiously illustrated. Three other lectures are expected from the Rev. C. Boutell, and the committee hope to add one from Mr. Grossmith, and also a musical entertainment. The Museum was opened on the first day of the present year, and it has far exceeded the expectations of those who have visited it. The curator's report states that nearly 60 individuals have made contributions to it. The greater number of these consist of natural history specimens, together with a few coins, antiquities, weapons, and other implements. The committee take the opportunity of impressing on the friends of the Institution, the importance of making the *local* collection as complete as possible, and hope to be further aided by the presentation or loan of fresh objects likely to be interesting to visitors, or possessed of educational value. The subject of classes is receiving much attention, and the committee hope to obtain some voluntary assistance from those competent to teach. Some valuable aid has already been kindly offered. Means are being taken to establish an elementary class, also others for music, French, and drawing. The natural history class has been held weekly since its commencement, on January 25th, and has generally been well attended. There has been given a course of seventeen lessons or familiar lectures on the mammalia, seven on mineralogy, one on birds' eggs, and eleven on botany. The Committee express their approval of the system of examination instituted by the Society of Arts, and the Hants and Wilts Adult Education Society. They believe it will have the effect of stimulating the formation of classes, which are becoming every day a feature of greater importance in the objects of Mechanics' Institutions, and that the certificate so obtained will prove of great practical value to successful students. The only member of the Alton Institution who has competed, W. H. Blake, jun., has just obtained a first class Prize and Certificate from the Hants and Wilts Society; and the Committee earnestly hope that his example will be followed by others at the next examination.

Bedford.—On the 7th inst. the usual half-yearly meeting of the members of the Literary and Scientific Institute was held in the Reading-room of the Society. Mr. Blower occupied the chair. The business transacted was of the usual character. Four gentlemen were elected to act on the committee in the place of those retiring by rotation. The retiring four were Messrs. Usher, Sergeant, Ballard, and Nicholls. The first three were re-elected, and Mr. Stowell in the place of Mr. Nicholls. A vote of thanks to Mr. Blower, for his conduct in the chair, was carried by acclamation.—On the previous evening Dr. Barker devoted an hour or two to an exhibition with microscopes, to which the members of the Institute had been invited. On the table were two instruments belonging to Dr. Barker, in addition to those recently purchased for the Institution from the Society of Arts. The large microscope which Dr. Barker had kindly brought with him was the object of much admiration; but the beautiful instrument which is now the property of the Society gave great satisfaction, and bade fair to be not only a source of amusement, but a stimulus to scientific pursuits. A large number of objects had been furnished by Dr. Barker, and the greater part occasioned equal gratification and wonder to all who were present.

Cornwall.—The Royal Cornwall Polytechnic Society opened its 24th Annual Exhibition on Wednesday, the 17th September. The Exhibition was, on the whole, deemed by the supporters and friends of the Society, to be of a satisfactory character, and especially in the most important portion of its operations—the Mechanical Department, the committee having this year devoted a larger proportion of the funds at their disposal, in prizes for mechanical inventions. Considerable attention was excited by an Induction Coil Machine, invented by Mr. J. N. Hearder, of Plymouth, which is said to be more powerful than that constructed by M. Ruhmkorff, of Paris, although the length of wire employed is very much less. Mr. Hearder stated that he had been enabled, by means of this apparatus, to develop an entirely new law of electrical action, on which subject a communication was made to the Society. In the Fine Arts department there was, generally, a good and interesting exhibition, and the Natural History collection, though small, contained some curious specimens.

London.—Royal Polytechnic Institution.—Nearly 200 persons have already formed the evening classes at this Institution. The classes in arithmetic, algebra, chemistry, and French, are very numerously attended. The regular course of instruction will commence next Monday, at seven o'clock. From a preliminary examination of the classes, which took place by the Professors during the last week, it is expected that at least 60 per cent. will attend the Society of Arts Examination. Some disappointment has occurred in reference to the delay in the supply of text books, and nearly all the students have been obliged to purchase them at the ordinary published price.

London and South-Western Literary and Scientific Institution.—A lecture, on the Genius and Career of Shakspeare was delivered at this Institution, on Thursday evening, the 9th instant, by Mr. Alfred Bunn, who afforded the greatest satisfaction to an unusually large and attentive audience.

Nailsworth.—The Report of the Literary and Mechanics' Institute gives an account of its continued prosperity, the number of members being about 150. Several additions have been made during the past year to the library, which now contains 671 volumes. Eleven lectures were delivered during the session, upon subjects of varied interest, and the attendance on the whole was good. The committee call attention to the important advantages which have lately been afforded to all the members of this and similar Institutions by the Society of Arts, in affording access to periodical examinations in various mental attainments, a proficiency in which secures, in some cases, appointments to offices of emolument and trust, and in others, entitles the successful candidates to certificates of merit, which become of great value to the holder.

To Correspondents.

Erratum.—In the last number, page 745, col. 1, No. 165, for "*The principles of Great Circle Sailing with Physical Geography,*" read "*The practice of Great Circle Sailing with the principles of Physical Geography;*" and insert No. 165a, For a simple Telescope of moderate price, to determine distances to 1,000 yards.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October* 10*th*, 1856.]

Dated 21*st August*, 1856.

1954. William Heap, Demus Sharp, and George Knowles, Bradford—Improvements in the construction of furnaces for economizing fuel and preventing smoke.

Dated 25*th August*, 1856.

1982. George Warriner, Withernsea, Yorkshire—Improvements in compounds for preserving, deodorizing, and fertilizing.

Dated 6*th September*, 1856.

2074. Henry Dyer, Plaistow, Essex, and George Dyer, Gracechurch-street—Improvements in freeing textile fabrics, cotton waste, and fibrous matters from oily and other impurities.

Dated 23*rd September*, 1856.

2225. John George Taylor, Glasgow—Improvements in fastenings, connectors, and couplings, and in the application thereof.
2226. David Ogilvy Boyd, 78, Welbeck-street—Improvements in constructing and arranging flues for the passage of air or smoke.
2227. Francis Wrigley, Long Island Iron Works, Carlisle—An improved friction coupling for the transmission of motive power.
2228. Robert Winterbottom, jun., Lancashire—Improvements in the mode or method of making or producing dry barm or yeast.
2229. Richard Husband, Manchester—Certain improvements in the manufacture of silk hats.
2230. Alfred Vincent Newton, 66, Chancery-lane—Improvements in gimlets, augers, and other tools which operate by a rotary motion. (A communication.)

2231. William Johnson, 47, Lincoln's-inn-fields—Improvements in machinery for doubling and twisting fibrous materials. (A communication.)

Dated 24th September, 1856.

2232. Arthur George Baylis and John Green, Redditch, Worcestershire—An improvement or improvements in the manufacture of needles.

2233. Andrew Barrie, Edinburgh.—A new or improved instrument or apparatus for registering the time at which workmen arrive at and leave their place of work, and for other such like purposes.

2235. James Cottrill, Studley, Warwick—Improvements in machinery to supersede hand labour in the operation of filing.

2236. Alfred Vincent Newton, 66, Chancery-lane—Improvements in carding engines. (A communication.)

2237. Peter William Barlow, Great George-street, Westminster—Improvements in the permanent way of railways.

2239. William Beatson, Rotherham—Improvements in puddling iron.

2240. Charles Vion, 133, High Holborn—Improvements in metallic moulds, and in the manner of using them for casting metals. (A communication.)

2241. Victor Frederic Antoine Prost, Paris—Improvements in weaving and in the machinery or apparatus employed therein.

Dated 25th September, 1856.

2242. Robert Brown, Glasgow—Improvements in taps or valves.

2243. Thomas Holmes and Thomas Aspinall, Pendleton—Improvements for preventing or diminishing the production of smoke in fireplaces and furnaces, and for effecting its combustion.

2244. Joseph William Wilson, Banbury—Improvements in machinery or apparatus for manufacturing parts of brooms and brushes.

2245. Carlo Sayno, Novara, Piedmont—Improvements in bearings, beds, or sockets for axles, pivots, or other rotary parts of machinery.

2247. Etienne Sabatier, Paris—Improvements in the permanent way of railways.

2248. Henry William Parnell, 13, Bryanston-square—The construction of ships and boats.

2249. Arthur Albright, George-street, Edgbaston—Improvements in the manufacture of lucifer matches, and of boxes suitable for containing the same.

2250. Robert Frost, Chester—Improvements in the manufacture of flour.

2251. John James Russell, Wednesbury, and Joseph Bennett Howell, Sheffield—Improvements in the manufacture of cast-steel tubes.

2252. Matthew Andrew Muir and William James Walker, Glasgow—Improvements in machinery or apparatus for sizeing or dressing yarns or threads.

2253. Samuel Calley, Brixham, Devon—Improved composition and compositions for coating or covering surfaces, particularly the bottoms of ships and vessels.

Dated 26th September, 1856.

2254. Claude Langlois, Bath—Improvements in photography.

2255. John Forster Meakin, 84, Baker-street, Portman-square—An improved fire escape.

2256. Marius Pellen, 68, Rue d'Anjou St. Honoré, Paris—Rendering impermeable by gas, caoutchouc, gold beaters' skin, paper, gauze, and similar materials used for things adapted to receive an ascending force, such as balloons, aerostatic machines, toys, &c., by the application of a peculiar varnish.

2257. Charles Renshaw, Dukinfield, Cheshire—Improvements in squeezing rollers, applicable to machinery or apparatus for pressing or partially drying yarns and woven fabrics.

2258. William Horsfall, Manchester—An improvement or improvements in cards for carding fibrous substances.

2259. George Gower Woodward, Kidderminster—Improvements in the manufacture of carpets.

2260. Frederick Ransome, Ipswich—Improvements in the manufacture of artificial fuel.

Dated 27th September, 1856.

2262. David Thom and George Aldcroft Phillips, Manchester—An improvement in "soap frames."

2264. John Boyd, Ashbocking, Suffolk—Improvements in letterpress printing machines.

2266. William Smith, Skinner-street, Snow-hill, and Nathaniel Fortescue Taylor, Stratford, Essex—Improvements in apparatus for measuring gas and other fluids, and in regulating the flow of the same.

2268. Captain John Montagu Hayes, R.N., 6, Portland-terrace, Southsea—Improvements in percussion cap holders.

2270. John Rothwell, Park-hill, Bolton—A certain composition and preparation to promote the ignition and combustion of coke, coal, and other combustible substances in stoves, furnaces, and grates.

Dated 29th September, 1856.

2272. Luke Duncan Jackson, Underwood, Selstone, Nottingham, and Henry Myers, 52, Rathbone-place—An apparatus for the better working of breaks in stopping railway trains.

2274. Charles John Carr, Belper—Improvements in operating hammers and stamps.

2278. David Thom and George Aldcroft Phillips, Manchester—Certain improvements in apparatus used in the manufacture of soap.

2280. John Lord, Rochdale—Certain improvements in the process of separating or recovering animal wool or silk from cotton and woollen or from cotton and silk or other mixed fabrics, whereby the animal wool or silk is rendered capable of being again employed, which said improvements are also applicable to wool in its unmanufactured state.

2282. George Tomlinson Bousfield, Sussex-place, Loughborough-road, Brixton—An improvement in the manufacture of artificial stone. (A communication.)

Dated 30th September, 1856.

2284. Samuel Ivers, Halshaw Moor, near Bolton-le-Moors—Certain improvements in looms for weaving.

2286. Robert Craib Ross, Glasgow—Improvements in paddle wheels for propelling apparatus for ships or vessels.

2288. William Gostwyck Gard, Calstock, Cornwall—Improvements in bits for boring and sinking.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2281. Henry Jenkins, Birmingham—Improvements in the manufacture of buckles and other dress-fasteners.—29th September, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed October 10th, 1856.

872. Robert Davis.
874. James Mash.
879. Robert Baird Lindsay.
880. Edwin Heywood.
884. Robert Richardson.
888. Joseph Barrans.
892. Leonard Kaberry and Aaron Horsefield.
893. Alfred Vincent Newton.
898. Thomas Jeffries.
946. François Jean Bouwens.
952. Joseph Auguste Marie Touet Chambor.
1107. John Henry Johnson.
1546. George Edward Dering.
1559. William Henry Hubbard.
1586. Robert Shaw.
1814. William Coltman.
1880. Chapman March.

Sealed October 14th, 1856.

882. Patrick Robertson.
883. John Symonds and Thomas Mara Fell.
895. Hugo Frederick Forbes.
909. William Edward Newton.
911. Wm. Armitage and Henry Lea.
915. Henry Young Darracott Scott.
1009. Thomas Restell.
1033. Rd. Archibald Brooman.
1048. Henry Atwood Thompson.
1067. William Bulmer and Isaac Sharp.
1091. Léon Louis Jardin and Joseph Blamond.
1198. David Shaw.
1653. Pierre Beauplant [illegible].

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

October 6th.

2295. William Henry Johnson.
2313. William Edward Newton.

October 7th.

2334. William Henry Muntz.
2348. Charles Scott Jackson.
2350. Charles Scott Jackson.
2469. Edward Austin.
2603. William Rodger.

October 8th.

2310. Henry Richardson Plimpton and James Leonard Plimpton.
2366. Andrew McLean and William Fraser Rae.
2408. John Wright Child and Robert Wilson.

October 9th.

2365. John Elce.
2375. Charles Coates.

October 10th.

2329. James Worrall, junr.
2335. James Webster.
2336. John Francis Porter.
2339. John Morison and Daniel Hurn.

October 11th.

2421. William Russell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3883	Oct. 6.	Railway Rug or Carriage Wrapper	H. J. and D. Nicoll	Regent-street.
3884	" 7.	Paragon Bonnet Support	Rd. Leake and Thomas Dodd.	230, Oxford-street.
3885	" 8.	Gas Apparatus for Heating Purposes	Henry Craigie	Edinburgh.
3886	" 10.	Medal Fastener	T. B. Bailey	Coventry.
3887	" 10.	A Fastener for securing Buttons to Boots, Vests, &c.	Thomas Greaves	Birmingham.
3888	" 10.	Apparatus to facilitate the Burning of Smoke in Furnaces	Henry Rawton	Leicester.
3889	" 11.	Improved Railway Guard's Belt Chronometer Case and Message Box	Charles Hippolyte Proteri	Duke-street, Lincoln's-inn-fields.
3890	" 14.	Machine for Paring, Slicing, and Coring	Richard Trimmins and Sons.	Birmingham.

Journal of the Society of Arts.

FRIDAY, OCTOBER 24, 1856.

◆

MEETING OF COUNCIL.—Oct. 22, 1856.

THE EXAMINATIONS.

The Council of the Society of Arts, in further developing the system of Examinations which they have established, and in enlarging its sphere of action so as to include Commercial and Trade Schools, desire to state their views in thus extending its principle. The Universities, the Inns of Court, the Military and Naval Colleges, the East India Company, the Colleges of Physicians, Surgeons, and Apothecaries, the various Government Boards, the Committee of Privy Council on Education, all provide examinations of various degrees of strictness for candidates who desire to obtain degrees, certificates, or employment. There is, however, a considerable number of persons, members of Mechanics' Institutions, Schools, and other bodies in Union with this Society, with regard to whom little or no provision of this kind is made for testing the attainments of those who would wish to procure private employment on the ground of merit, or to obtain a formal judgment pronounced upon their acquirements by a competent tribunal.

The Council also desire to secure systematic study and punctuality of attendance in the several classes of the Institutions in Union with the Society.

On the recommendation of the Board of Examiners, they have passed the following minute:

"That no person shall be eligible for examination who shall not have been for six months at least previous to the day of examination, a member of a Mechanics' Institution, School, or other body in Union with this Society."

"That no graduate or under-graduate of any university of the United Kingdom, no student of any of the learned professions, no certificated schoolmaster or pupil teacher, shall be eligible for examination by the Society's Examiners.

"That no person under fifteen years of age shall be admitted to examination.

"That every candidate shall undergo a previous examination in writing from dictation, and correcting faulty English composition, to test the handwriting, spelling, and knowledge of English grammar possessed by each candidate.

"That no candidate shall be examined in more than three subjects."

The Council have the pleasure to announce that Mr. Henry Johnson, of 39, Crutched Friars, has placed the sum of £90 at their disposal in such a manner as may best promote the success of the Society's Examinations.

The Council have received the following memorial, bearing the signatures of the Dean of Hereford, the Bishop of Winchester, Lord Carnarvon, the Bishop of Salisbury, the Hon. and Rev. S. Best, and Mr. Wyndham Portal.

To the Chairman and Council of the Society of Arts, &c.

We the undersigned, the Vice-Presidents and Officers, on behalf of the Hants and Wilts Adult Education Society, representing seventy-six Institutions in union with it, and now assembled in Annual Conference at Basingstoke, would respectfully draw the attention of the Council and the Board of Examiners to the subject of its examinations, praying it to take into its consideration the expediency of holding an examination for the southern counties, and especially those in which the Hants and Wilts Adult Education Society is directly interested, at Salisbury. The saving of expense to the candidates, the diminution of inconvenience to their employers, and the removal of many of the difficulties and drawbacks which attend their examination in the metropolis, are evident, and lead us, with every wish for the success of the Society's movements in this direction, and thankfulness for its aid, to pray it to remove an evident imperfection in its scheme, by extending its number of local examinations, and by giving to the South an advantage that the Society has notified its intention of giving to the North.

October 7th, 1856.

The Secretary was instructed to reply

That the Council, considering how recently the system has been established, are of opinion that it is not expedient for the present to have more than one centre for examinations in the country, and having already fixed upon Huddersfield for the year 1857, they are compelled reluctantly to postpone the acceptance of the invitation received from the Hants and Wilts Adult Education Society.

The Council have received the following letter:—

To the Chairman of the Council of the Society of Arts.

Sir,—The financial position of this country, and the enormous national debt, must always be subjects of great commercial importance, and of grave interest to Englishmen, even during the times of peace and prosperity.

Recent events of great importance, such as the influx of gold from Australia and California, the drain of silver to the East Indies and to China, the establishment of Free Trade, and the vast extension of our commerce, have materially altered the financial position, and will cause a revision of the subject to be very useful and interesting.

The important results that might be obtained by the renewed application to the reduction of the debt of the principle of compound accumulation, the essential principle of the Sinking Fund, which has unfortunately been abandoned, appear also to merit a further examination, and I am convinced that the interests of Arts, Manufactures, and Commerce, would be promoted if the Society would encourage the investigation of these subjects, and elicit the mature opinions of those who have studied financial science.

As, however, the funds of the Society are devoted to objects of great national interest and importance, I shall have pleasure in offering a prize for the discussion, should the Council approve of the proposal.

That is to say: a Prize of Two Hundred Guineas for the best Essay on the present financial position of this country, as affected by recent events, in which the principle of a Sinking Fund should be discussed, and also an investigation made as to the best mode of gradually liquidating the National Debt.

I am, Sir, your very humble servant,
HENRY JOHNSON.

London, 39, Crutched-friars, 14th October, 1856.

The above letter having been read—

"It was resolved that the best thanks of the Society be conveyed to Mr. Johnson for his very liberal offer of a Prize of 200 Guineas, and that the same be accepted on the conditions stated in Mr. Johnson's letter."

WHAT TO LEARN.

THE HITCHIN MECHANICS' INSTITUTION AND THE SOCIETY OF ARTS EXAMINATIONS.

The Rev. Dr. Booth, F.R.S., delivered the following Address on the opening of the Exhibition at the Mechanics' Institution in this town:—

I shall speak to you this evening about the present aspect of education in this country, and the probable future phases of its development. I shall attempt to prove to you that it is no longer a mere social want, that it has become at least for us a political necessity. At Lewes the other day I dwelt at some length on the various difficulties, many real, some imaginary, which beset the path of the learner and impede his progress. I showed that many obstacles may be overcome by perseverance, while others may be eluded by a little foresight, and that in the same way, as happiness is not the exclusive enjoyment of the rich, nor misery the unfailing lot of the poor, so the facilities for acquiring knowledge are not so entirely the inheritance of those who are born to ample wealth and abundant leisure as the world generally imagines. Were it otherwise there could be no healthy circulation among the constituent elements of society. It would become stagnant. The rich being in possession of every social, intellectual, and moral advantage, would never take the lower place to make room for the poor man, bidden by the great Master of the feast to take the higher seat. Having endeavoured to show on that occasion how a young man should learn, I will now proceed to discuss what it is he ought to learn. Now, in the first place, let us contrast the present amount of knowledge, widely gathered and safely garnered up in books for the use and advancement of mankind, as compared with the stock the world was in possession of some three or four centuries ago. Because a careful examination of this matter will plainly show you that there is much valuable knowledge and much important information which the most highly gifted, and the most indefatigable must be contented to continue in ignorance of; that no length of life, no amount of leisure, would enable a man to master the circle of the sciences, as it is called; and that the existence of an Admirable Crichton, at all times a myth, has now become an impossibility. We must introduce into intellectual acquirements that principle of the division of labour which has long since been admitted into and acted upon in the various departments of mechanical and commercial industry. Knowledge, then, and ignorance, like virtue and vice, or pleasure and pain, if they do not go hand-in-hand, are yet not far distant from each other. Though the actual amount of our individual acquirements may increase, our relative ignorance grows in a much higher ratio, because the sum total of human knowledge, in all its various subdivisions of literature, science, and art, is marvellously augmented, from day to day, nay—from hour to hour. The horizon of human knowledge is widening and clearing up in certain directions, while in others an impenetrable veil of cloud rests and ever will rest upon it. Now, this individual increase, coupled with relative diminution in the acquisition of knowledge, serves to draw tighter the bonds of human society, it makes us more dependent upon others, and our neighbours upon us. We find the very same principle holds in the community of nations. What would become of commercial intercourse or national sympathies, or the spread of civilisation but for this—that the means of supplying the multiplied wants of man in society are to be sought for in every clime. This makes the whole earth to be virtually "of one language and of one speech." Two centuries ago in this country, and indeed all over Europe, learning was synonymous with erudition; a man of great knowledge was a man who had read great books. In those days the inquiry was not, is it true? but who asserts it? Belief was founded neither upon reason, nor upon evidence, but on authority. Truth stood a veiled form at the entrance to the temple of knowledge, and her veil was not to be hastily or rashly drawn aside. There must be esoteric and exoteric teaching, that is, one form of doctrine for the enlightened, another for the ignorant. It is not at all strange that in the infancy of society, teaching should be based upon human authority, that the *ipse dixit* of the professor should supply the place of proof. The old Greek proverb applies as well to the childhood of nations as to that of individuals. *Δει μανθανοντα πιστευειν*—the learner must have faith. The beginner must receive the elements of knowledge upon trust. He cannot until afterwards know them to be true. So very modern is that superstructure of science, in whose courts we all more or less learn to pay homage, that 200 years ago, you will be surprised to learn, mathematics were little known or even heard of in the University of Cambridge. The celebrated mathematician, Dr. Wallis, writes: "Mathematics were scarce looked upon as *academical* studies, but rather *mechanical*, as the business of traders, merchants, seamen, carpenters, surveyors of land, and almanac makers in London. Among more than two hundred students in our College (Emmanuel College), I do not know of two who had more than I, if so much, which was then but little, and but very few in that whole University. For the study of mathematics was then more pursued in London than in the Universities." What a change has since come over the spirit of the place. For many years past mathematics, with classics, have been cultivated at Cambridge, to the exclusion of the other not less important departments of literature and science. It is, however, a symptom of healthy progress that this contracted fashion is passing away, and that Cambridge will vindicate its just claim to the title of a University by recognising the universality of knowledge. And indeed the change has not come too soon. Look at the new sciences which have started into existence and shot up into importance within the last sixty or eighty years. One hundred and fifty years ago the little science there was then discovered could only be reached through the Latin originals, or by the help of Latin translations. It was in this way only that a man could study the works of Euclid, Archimedes, or Apollonius. So well established was this custom of burying living knowledge in the tomb of a dead language, that Lord Bacon having first thought out and written in English his great work on the Advancement of Learning, had it translated into Latin under the title "De Augmentis Scientiarum." Now, the range of knowledge is becoming so vast, so entirely beyond the compass of any one man's comprehension, however ample his leisure or untiring his industry, however tenacious his memory or intuitive his intellect, that no one can hope to master more than a small portion of our present knowledge; the possession of a nugget or two of this vast intellectual treasure must content us. The practical question, then, with which you have to deal is this—on what principle are you to make your selection. Believe me, it is much better, under every point of view, to know two or three subjects well, than to have a loose rambling sort of notion as to what several are about. This is no needless caution at the present day, when a diligent sitter out of lectures may during a session assist at lectures on astronomy and astrology, optics and clairvoyance, medicine and mesmerism, mining and music, electricity and animal magnetism, geology and conchology, physiology and a whole heap of ologies besides. Do not imagine that a man is at all the more clear-headed, or even the better informed, for having all this farrago and jumble of odds and ends, of bits and scraps of knowledge shot into his memory, as a carter shoots rubbish into waste ground. A man's mind which receives impressions in this way is no better than the sheet on which one may see dissolving views thrown in a chromatic exhibition. The figures mix, and blend, and fade into each other; while, on the other hand, if you look through a telescope, although the objects you examine are but few, remember how bright and distinct they are, how precise their outlines, how sharp their edges. Much better is it for the traveller to have exact information about a few prominent distant objects by the help of a glass, than to gaze at a whole country's side through a haze or fog. I believe these remarks are not mistimed in this age of cheap books and light literature, as it is called. You are not to imagine that every hour you dream over a flimsy tale or threadbare fiction is so much time cut off from amusement, and given to mental improvement. The time thus passed in reverie over the pages of a novel may safely be put down under the same head as time passed in singing or dancing, or any other like harmless amusement. It is seldom better spent, and very often worse. I am not finding fault with this kind of reading, I only contend that it should not be set down for what it is not. It would be a very pleasant thing for all of us if we could acquire knowledge in this way, just as you farmers would find it very pleasant and profitable if you could grow wheat by merely casting the seed on the green sward. You can no more reap knowledge than you can reap corn without the sweat of the brow, whether it be from within or without. You may write letters with your finger in water, but you must use the chisel and the mallet—you must strain the muscles of the arm—to grave them in marble. When light reading was scarcely known, and novels were as ponderous as a blue-book on the currency, that profound thinker and acute reasoner Bishop Butler observed:—"The great number of books and papers of amusement which, of one kind or other, daily come in one's way, have in part occasioned, and most perfectly fall in with and humour this idle way of reading and considering things. By this means, time, even solitude, is got rid of without the pain of attention, neither is any part of it more to be put to the account of idleness, or spent with less thought, than a great part of that which is spent in reading," —and to the same effect by another great authority:— "Nothing," says Dugald Stewart, "has such a tendency to weaken not only the powers of invention but the intellectual powers in general, as a habit of extensive and various reading without reflection. The activity and force of the mind are gradually impaired in consequence of disuse, and not unfrequently all our principles and opinions come to be lost in the infinite multiplicity and discordancy of our acquired ideas." These are very important points to be settled by you who propose to turn your attention to your own improvement. What are the considerations which are to determine your selection? For what point of the compass are you to make? While sailing down a river you want no compass to guide you, it is when launched upon the shoreless ocean that you require the aid of maps and charts, and all the help of scientific navigation to direct you. At the annual dinner of the Society of Arts in the Crystal Palace last Midsummer, our Vice-president, Lord Ashburton, in his address from the chair, wisely and well observed:—"Let us but remember what we are about—we are fitting out man for the struggles of life; we are not fitting up a storehouse for the use of a philosopher. Man goes forth into the world as a soldier goes forth into a campaign. His wants are boundless, his means of carriage are small. Can any service be greater than that of planning out and assorting his pack of knowledge, rejecting all that shall cumber his movements, selecting all that may afford materials for the work he has to do? Surely there is no more urgent task for us to perform than that we should employ our wisest heads to consider man's powers—to consider man's necessities—to consider man's position in relation to his Maker, his duty to God, to himself, and to his neighbour, and then decide upon what principle that small pack of knowledge shall be composed, which he can advantageously bear with him into life. This is the question of questions,—a question that demands for its solution the highest qualification of the priest and the philosopher, while we leave the question to be decided by the unlettered mechanic. Man's wants are boundless; his means of carriage are small; life is short—school-time is still shorter—knowledge is infinite;—what shall his pack of knowledge be?"

Now, in reply to this important question, so forcibly put by Lord Ashburton, one may, I think, safely lay down two general principles for our guidance in this difficulty. First, that the knowledge in question may be used as an instrument of intellectual development, as an exercise of the understanding; and, secondly, that this knowledge may be capable of practical application. Regard not the acquisition of that knowledge which will not stand these two tests. Now, let me explain myself, and illustrate what I am saying. I know of no mental gymnastics which can stand for one moment in comparison with the study of logic. I mean the ancient Aristotelian logic, with its whole theory of syllogistic reasoning, and the perfectly rigorous demonstrations by which the propositions are established. I believe that, as a whetstone for sharpening and putting a fine edge on the understanding, giving great precision of definition, and accuracy in drawing legitimate conclusions from given premises, shutting out the truth or falsehood of the premises themselves, the old logic of the schoolmen, as they are called, stands unrivalled and unapproachable. The study of mathematics under this one point of view is not, in my opinion, to be compared with it. There may, however, be some doubt as to the position the study of geometry holds with regard to it; certainly none as respects analysis. Now, notwithstanding all this, and though it had besides the prestige of centuries in its favour, the study of the ancient logic has been almost if not quite abandoned in all our universities. The spirit of sound reasoning still hallows their courts, but its outward form reposes forgotten in the dust on their shelves. Why was this? Because the study of logic failed in this characteristic, that of manifest applicability, because it was hustled out of its place by studies of more palpable utility. Logic may have strengthened the grasp, may have nerved the intellectual muscle; but it provided no well-defined mental engine, like mathematical analysis, or the doctrine of atomic weights, which enable their possessors to master the stubborn resistance of nature. Your labourers in the field do not practise gymnastics, because they sensibly feel that their daily toil gives them quite enough of muscular exertion. So, in our own day, men cannot afford the time to whet their wits on barren studies, no more than our merchants can afford to take exercise of a morning by walking into town, when they are forced to rush in to their offices by the rail. Again, a knowledge of Roman law would be a most useful acquirement; but how can any one give his whole time to it, while new discoveries in knowledge are matters of daily expectation? I now approach another question of great delicacy, and one on which a wide diversity of opinion exists. I speak of the study of Greek and Latin in commercial schools. We all of us know that it is no uncommon thing for a boy to spend five or six years of the most valuable, because the most impressible, period of his life in getting by heart the rules of a language he is never to have the good fortune to learn; to waste his energies in putting up a scaffolding for a building of which he is never to lay a single stone. What can be more ridiculous than that a boy who is intended to work at a trade, or to serve out goods behind a counter, should stupify himself in getting by heart dead rules and exploded forms? exploded by a more recent and deeper insight into the mechanism of language. And this is not the worst; but that same puzzled little boy must have crammed into his memory long strings of exceptions to those grammar rules, gleaned by the laborious inquisitiveness and microscopic curiosity of old grammar-makers, who had nothing on earth else to do but to gather them out of the musty pages of the forgotten works of third and fourth class authors. To a boy who is leaving school next half, to deal out soap and sugar from behind a village counter, or to look after a steam-engine, how valuable and important a fact it must be for him to know that an exception to such or such a rule is to be found in Columella or Varro. Sidney Smith puts this point very forcibly and wittily. "Cicero, in his 'Offices,'" says the reverend reviewer, "tells a whimsical anecdote of Cato the Censor. Somebody asked him what was the best mode of employing capital? He said, to farm good pasture land. What next? To farm middling pasture land. Well, but after that, what the next? To farm bad pasture land. Now, the notions which prevail in England respecting classical learning seem to me to resemble very much those which the old Roman entertained with regard to his favourite method of cultivation. Is a young man able to spare the time necessary to enable him to pass through the University? make him a good classical scholar. But a second, instead of residing at the University, must go into business when he leaves school. Make him a tolerable classical scholar. A third, has still less time to snatch up knowledge, and is destined for active employment while still a boy. Make him a bad classical scholar. If he does not become a Porson or a Heyne, he may learn to write nonsense verses. If he does not get on to Horace he may read the first book of Cæsar. If there is not time for such a degree of improvement, he may at least be flogged through that immemorial vestibule of learning—*Quis docet:* who teacheth? *Magister docet:* the master teacheth. Would to heaven that he taught something better worth knowing."

Now, I do not undervalue classical learning. As an instrument of developing the faculties, and available for that purpose with most minds, I think highly of it, but only when pursued to a considerable extent. "Drink deep or taste not," is the true maxim in learning classics. Now, if a man learns and knows the First Book of Euclid, even though he should never proceed to the second, he will have made an acquisition which will, so far, not only improve his reasoning faculties and exercise his memory, but will afford him knowledge, small though it be, that may be of considerable use to him afterwards. When it is intended that a young man shall proceed to College, I am convinced that he should endeavour to acquire a thorough knowledge of the classical writers of antiquity, not merely with the dead forms and fixed idioms through which they gave to the world their ideas, but with their modes of thought, their methods of investigation, with their political and ethical opinions, their solutions of social questions, with their views, sometimes luminous, often narrow, on the constitution of society. He should make himself thoroughly acquainted with the course of historical events developed under forms of government and modes of executive administration, differing so widely from our own, with the usages of peace and war, and the rules of international law so abhorrent from those of modern times. He will then learn how vague were their notions of freedom, how little of individual liberty—our great boast and privilege—existed. How tyranny lurked under all their forms of government. He will then discover that while they pushed certain speculations to the very utmost verge and limit to which they have been advanced or can be extended by human reason, they in other abodes of knowledge stopped short at the threshold, unable to grope their way through the palpable darkness which lay before them, through the want of the guidance of a method, which, *cæca regens filo vestigia*, might lead them through the unexplored recesses of nature. And he will be humbled by the reflection, that while for them the paths of abstract science were illumined by the bright sunshine of truth, in other regions, where discovery is of far higher importance to man, they had but feeble and fitful glimmerings, and saw as but "through a glass darkly" the line of duty shadowed out before them; and that the wisest of them without "a light unto their paths," fell short of great truths which are now so obvious, so universally admitted, that they have passed into the constituent elements of our knowledge, into our common rules of action, and gone beyond the platform of discussion. When pursued to an extent even approaching to this, the study of classics as a mere instrument of mental discipline is invaluable. But to keep a lad for five or six years over the unintelligible rules of a grammar or syntax, which treat of things about which he has not the remotest conception—for to understand rules tacitly pre-supposes a knowledge of the language—and about which it is not intended he shall ever have any clearer notion, is, I say, an absurdity so incredible, that if we had not proofs of it in the misdirected instruction of almost every youth who goes to a middle-class school, we should utterly disbelieve it. Would not a boy exercise his memory quite as well, and somewhat more profitably, in getting by heart the beauties of Shakespeare, Milton, and our other classical English authors, as in grubbing his way through *quæ genus* or *as in præsenti*, or the Eton Latin grammar, or such like, to him unintelligible stuff. Oh, but some one will say, a knowledge of classics, however slight, improves one's English style. Now this, too, I question. If a tithe of the pains which are bestowed on the minutiæ, on the refinements, on the elegancies of Greek and Latin prose and verse too, which is even still more absurd,—were the same labour and study, I say, expended on the acquisition of a pure, manly, vigorous, graceful, and idiomatic English style, we should not have so much incorrect, slipshod slang, as is daily written amongst us. The man who would blush at being detected using a phrase of doubtful Latinity, writes without compunction or hesitation any sort of shambling English that comes uppermost. Those old Greeks, whom we in vain attempt to rival, who were masters of the art of composition to a degree of perfection which has never since been equalled, knew no language but their own, and despised every other. To perfect and polish the Greek language they bestowed all their care, and that care was not bestowed in vain. Instead of copying their results we should strive rather to follow their mode of procedure. Again, it will be said the histories of those ancient nations supply us with examples of fortitude, heroism, magnanimity, and of all those bright virtues which adorn humanity. That to retard the influences of modern deterioration, we should keep those splendid illustrations before our eyes. Now this is true no longer, however just this view may have been in the infancy of modern society, when mankind had only just emerged from the long night of barbarism, when it was but natural that they should look upon the east with feelings of the deepest veneration, associated as it was in their minds with everything great, noble, and good: hallowed too by the belief that "the light which lighteneth every man that cometh into the world" first dawned upon mankind from Bethlehem's lonely shed. To them it was the birthplace of the only intellectual and moral greatness which throughout the earth's vast round had raised man's race above the beasts that perish. But we have now no need to search the annals of antiquity for such examples. We must not laud them overmuch, nor consign our own to dumb forgetfulness. The East lives in the memories of the past, the West is the stage of action at this present. We are no longer exclusively beholden to the records of Greece or Rome for standard examples of intellectual or moral greatness. We may boldly compare Shakespeare with Homer, or Newton with Archimedes, or Bacon with Aristotle, and the comparison need not be confined to these. In deeds of noble daring we do not concede the palm. To go no further than the late war: we may set it over against the proudest achievements of ancient chivalry. The battle of the Alma may well be matched with that of the Granicus; the field of Balaklava may vie with that of Marathon; and the heights of Inkerman are more glorious than the passes of Thermopylæ. But neither in ancient nor modern story can we parallel the unsurpassable grandeur of the self-immolation displayed on board the sinking Birkenhead. You are all, no doubt, familiar with this noble manifestation of British fortitude, which braves death in the discharge of duty. The ship Birkenhead was engaged to carry troops to the Cape of Good Hope, when near the termination of her voyage, she struck on a rock at some distance from the coast of Southern Africa. In a short time it was ascertained that nothing could save the ship. She was fast sinking; the boats were all launched, and drawn up alongside the vessel. Did the soldiers, the strong men, breaking loose from all discipline in the face of impending death, rush forward and each for himself struggle to secure the best place he could in the nearest boat. Life was sweet, and why should he not make an effort to save it? No, that was not the way the British soldier acted. The women and children were placed deliberately and carefully on board the boats by their illustrious leader, Major Seaton, and sent off for the main land, while the men fell into their ranks on deck, as if on parade ground; thus silent, collected and undismayed, they stood, while the ship was slowly settling down. Unflinchingly they met their self-imposed doom. So these men died, neither urged on by some fanatical conviction, nor in the excitement of the battle field, nor in the presence of admiring multitudes of sympathising spectators, but far away beyond the sight of men, on the solitary bosom of the ocean, the wide horizon unbroken by a single sail or speck of life. Under His all-seeing eye alone, while the grave opened to receive them, they gave back this practical answer to their country's watchword, England expects that every man will do his duty. Whole armies are not equivalent to such a deed as this. So long as English History shall be read—so long as the English language shall be spoken—so long as the name of England shall be heard, the glory of this deed will not grow dim; and so long as true greatness is held in honour among men, the moral grandeur of this self-sacrifice will never be forgotten. Now, a nation which can claim such men, and glory in such achievements, requires not to be stimulated by the examples of the illustrious men of other nations, or by the records of departed greatness. The Englishman of our time can find in the poetry, oratory, literature, and science, patterns of excellence which cannot be surpassed. In the noble deeds of men, whose names as household words are familiar to our ears, he will behold examples as bright and glorious as any that are to be found in classic legend or modern history. But to return from this digression. There are other and more pressing considerations which will suggest to you, and to many others as well, the direction you ought in prudence to give to your reading. Just observe the change that is rapidly taking place in the standing and emoluments of what are called, by courtesy, the learned professions in this country. Take the Church, for example, and I am now looking at it not as a religious institution, but simply as a profession. What startling but faithful pictures do the columns of the *Times* for the last few weeks disclose, of clerical starvation and surpliced destitution. The working clergy of the Church of England are fast lapsing into the original poverty, but not the primitive dignity, of the early Christian church; and the worst feature of the case, what renders a remedy to this state of things hopeless, is this, that for every wretched piece of preferment as it is called, there are fifty applicants. Why? you can hire a curate for less than you can a ploughman or a blacksmith. The labourer is worthy of his hire, and a labourer's wages he receives. Again, look at the condition of the Bar. It is stated, apparently on official authority, that there are no less than 40 sets of chambers now to let in the Middle Temple, and that the entries of students are about one-fifth of what they were 10 years ago. The calls to the bar have fallen to a mere nothing, compared with what they were formerly. Whereas, the Middle Temple used to call a few years ago from 120 to 130 a year, 20 is now about the average, and even this number shows symptoms of decrease. If this statement be true, and I have no reason to doubt the authority of the *Globe* newspaper, which asserts it, the profession of the bar, so far as it concerns the great body of the public, may be said to be extinct. There is no good citizen whose views extend beyond the present moment that will not regret this weakening of an honourable and high-minded profession, the great assertor of our national liberties, when those liberties had not as yet been placed on their present apparently secure basis. The medical profession is very little better. The physician of fifty years ago, his guinea fee and handsome carriage, are become scarce; the surgeon is rarely met with now out of large cities; the apothecary is fast disappearing. We shall all of us soon be in a position to say with Romeo in the play, "I do remember an apothecary." The general practitioner becomes the sole representative, and inherits the callings of all three, "tria juncta in uno," he prescribes, compounds, and operates. Thus the old established professions are starved by the multitudes which are crowded together in them, and are still crowding into them. While that vast variety of industrial employments, those unnamed and unrecognised productive professions which are unknown to the Earl Marshal, and which have neither station nor precedence in the herald's programme; these are the main support, the strongest stay of the vast industrial and commercial prosperity of England. Of these are the men who go forth and build the aqueduct, and level the railroad, and lay down the electric telegraph along the trackless wild, or submerge it beneath the ocean. Of these are the men who are the true pioneers of civilisation. Look at the work that remains to be done, and who are the men that are to do it? The vast regions of India and Central Asia, the trackless forests of Canada and the barren steppes of Australia are yet to be scored with railways, while earth's globe itself must be interlaced with the invisible bands, and the net work of the electric telegraph. Canals are to be dug, forests cut down, savage regions to be opened up and made accessible to civilisation and Christianity. The vast llanos of South America, the enormous basin of the Amazon, sufficient to grow corn for the whole of earth's existing population remain yet to be reclaimed. Who is to bring into the family of nations Australia, with all its secret hoards of unimagined treasures, reserved as it were by a special Providence to be discovered in our day to supply the exchangeable capital which renders such works a possibility. And now, what nation but ourselves is to undertake any of those great works? Surely not the effeminate and worn-out tribes of the east? Surely not those nations smarting under oppression, and whose thoughts are of insurrection. Not America, with that speck of black cloud on the southern horizon, and threatening a tempest as violent as one of their own tornados. We must supply, if not the manual labour, the heads to guide, the science to suggest, and the capital to provide for their execution. This is the work which is given us to do, and a proud and glorious work it is. But, you will say, how does all this affect us? How do these considerations bear upon our interests? Why, in this way. You will see Englishmen everywhere abroad, conducting the great manufacturing and engineering establishments. On the platform of the locomotive, and the engine-room of the steamer, he is to be found. Now the elements of the knowledge which lie at the very root of all those industrial professions of which I have been speaking, and from which they draw all their strength, are at this present time being taught in the classes of Institutions such as this all over the country. Thoughtful men, of every religious sect and political party, admit the necessity of instruction. You have the means placed before you of acquiring the elements of those sciences on which rest all the great discoveries of this present period of man's history, whether it be the science of pure space or mathematics, with its applications to astronomy and navigation, or mechanics as developed in those great inventions, the power loom and the steam-engine, or chemistry in its multitudinous applications, embracing every variety of manufacture, or electricity, as exemplified in the wonder of this age, the telegraph. Need I name agriculture, which has become a practical science instead of an empirical art. There are other subjects, too, the mastering of which implies the acquisition of a large amount of useful knowledge. From these you are to make your choice; you will be guided in your selection by the tests I have laid down, and by the natural aptitude of your faculties to grapple with one subject rather than another, for the Almighty has constituted our faculties as diverse as the subjects on which they are employed. I do not undervalue knowledge of any kind. All knowledge is useful, or at least may be made useful. But how are we to learn these things, you will say; our time is short, our duties many, our employments engrossing. Were a ploughboy to say to me, I cannot let my master's plough and horses stand idle while I am working out a sum under the hedge, I should reply to him, To do so would be to violate your duty, and the discharge of duty has the first claim upon you. But let us consider this matter a little, and the present illustration will do as well as any other. It is a great error to imagine that you can work out a subject only when you have it before you in the shape of books and papers. You can often more clearly realise, bring it bodily before you, while you are walking in the fields, or journeying along the road, or going to market, or driving the plough. There is no need that you should "whistle at the plough for want of thought." It is told of Brindley, the celebrated engineer who constructed the Duke of Bridgewater's canal, that when perplexed with some engineering problem of peculiar difficulty, he used to betake himself to his bed, and in the silence and solitude of his chamber work out the solution. While engaged in your work, if it be merely mechanical, requiring no continued exercise of foresight or skill, you can turn a subject of thought over in your mind; you may start difficulties which can only be set at rest by going back for fresh food for thought to the book you had been reading. When, the other evening, you were gazing at that magnificent spectacle, the eclipse of the moon, predicted years ago as certain to occur at the precise moment of time it actually did commence,—and this, by the way, is an unerring test, a rigid proof, which the meanest understanding can comprehend, and which the most prejudiced must admit, of the reality of our knowledge, of the solidity of the foundation on which all scientific truth is based: I say, when you were examining this phenomenon, you observed how confused and dim every outline appeared, until you brought your glass to the exact focus. So it is with external things, and with subjects of internal contemplation. They are all clear in themselves, if we could only bring the mind to the precise focus for their examination. And, while on this point, I may as well give you a caution or two. Many persons, especially those who are called quick readers, have a notion that when they get through a book, as they do through an article in the newspaper, they have mastered the contents of what they have been reading. They have fallen far short of anything of the kind. To read a book so as to expect to acquire any knowledge of it, if the book be worth reading, you must deal with it as a lawyer does with a brief. You must pencil-mark the important passages, underscore the points which the author makes, interline his arguments, and bracket his propositions. Then, read the book over again, and make an abstract of it; a little practice will give you facility; you will be surprised, in the first place, at the clearness, firmness, and precision of your knowledge of the book; and, in the next place, you will be astonished at the smallness of the compass within which the essence of a volume of considerable size may be condensed. The process reminds one of those preserved meats in air-tight canisters, which concentrate all the nutritious properties of the flesh and bones into a small compass. When you try this experiment, you will be surprised to find how much, even of the best books, are made up of what the masons call rubble stuff,—with matter which is either superfluous, irrelevant, or twaddle; so true is the remark of the critic, "*Aliquando bonus dormitat Homerus.*" But this you will say would take a great deal of time, would cost a world of trouble, and be a very irksome process besides. And how could we afford to spend so much time and trouble on one book, while new ones shower down upon us thick as leaves in autumn. Just so, and hence the truth of the old saying—Beware of the man of one book. The multiplicity of your reading so dilutes your attention, that it retains no flavour of any. Now, before I conclude, I would earnestly desire once more to impress this great truth on your minds—and it cannot be too deeply cut into them—that your power of learning does not depend so much upon what is called talent and cleverness, as on the ability to bring the whole light of the mind to a point, and to keep it there. But, this has been overlooked; talent and ability have been praised, as if they were the great instruments of success, while power of concentration, a great and rare gift, has been undervalued as plodding. How often do we hear, "Oh! he is a very clever lad, he sees things at a glance. I should not be surprised if, one day or other, he became Lord Chancellor;" and of another we hear, "Oh! he is a man of great genius, of wonderful talent, but he has never applied himself to anything," as if his great talents were an excuse for his idleness, and not the very contrary, if there be any truth in the parable of the talents. Such men are lights that shine, but they reflect no heat: and they are often admired by silly persons and flatterers—for flatterers stick to such men like barnacles to a ship lying idle, and growing foul in harbour. But, as I was proceeding to say, the great instrument of intellectual success is power of concentration, and this concentration is produced by the will excited to action by the emotions. How mysterious is the action of the memory! Do we not, all of us, remember fragments of trifling conversations, of our going once upon a time to a particular place, and of our meeting certain people: Have we not, all of us, a recollection of matters so insignificant as the flowering of a particular shrub, or of the cawing of a rook, or of being at school on a particular day, or of crossing the river in a boat, all of them events occurring in remote childhood, and engraved on the memory in characters of ineffaceable distinctness, while other events of great importance and moment, nay, whole subjects of study are clean gone and utterly forgotten. These are the mysteries of memory. Who ever forgets occasions of great grief or excessive joy? Let it then be an encouragement to you who are not geniuses, to you who have not talents to boast of, that learning a thing, that understanding a subject, is not so much a matter of refined intellect as of unflinching perseverance and intensified attention. When some persons one day were extravagantly admiring—if it could be extravagantly admired—the transcendant genius of Sir Isaac Newton, and his wonderful powers of discovery, he is reported to have replied that the power of patient thinking was the only faculty in which he was conscious of being superior to other men. Patient thinking—what a volume is contained in these words. You are not to imagine that the men who have enriched the world with their discoveries, went into their libraries or studies once upon a time, and having shut their doors, sat down and said to themselves—we will now set about making discoveries, as a man might say, I will sit down and write a letter. No! discoveries are not made in that way, but rather in this. A stray hint or two is given on a subject, in which the mind takes a great interest. It may be dropped in accidental conversation, or a remark made in a book puts the mind in action, not in the study, but in the counting-house, or the open field, or possibly behind the loom. Another hint to these is added, the clue followed up leads to nothing; on doubling back it fastens on another. In this it is more successful: it leads to something not known before, but there it stops. The thing appears hopeless, and is dropped. But after awhile the mind involuntarily reverts to the inquiry, it broods in silence, it exemplifies the patient thinking of Newton, it tries some other clue, again is baffled, at last, it may be, some happy thought flashes across it as lightning from the cloud, the clue is seized, the curtain draws up, and the whole discovery stands revealed like a panorama, in all the freshness and brightness of unclouded truth then first made known to man. I would only add that these discoveries are published to the world in a very different order from that in which they are made. The chain which connects the new discovery with long-established truths is generally the last part of the work that is constructed. What I have said will explain to you how prizes, certificates, and such-like inducements actually enlarge the capacity for acquiring knowledge; the understanding computes the value of the inducement, and this calculation excites the emotions, and thus intensifies the power of attention. The hope of reward is one of the very strongest and most influential of the principles of human nature. For one man who is deterred by the fear of punishment, a thousand are stimulated by the hope of reward. Look at the comparative influence of these two principles on our criminal population. And this by the way suggests an overwhelming argument in favour of industrial education, I mean that education which includes the training of the head, the heart, and the hand, and no education for the poor deserves the name which does not embrace all three. This is the three-plied cord which binds into one strong compacted beam, those elements of man's nature which, separately taken, are frail and brittle. Look at the great moral changes which are now being effected in our juvenile criminals, by the reformatories which are doing so much good over all the country at this present time. How can any man with these patent established facts before him, stand up and deny the great use, the overwhelming need there is for industrial instruction. Now, here are youths, born in sin, pilferers from their cradle, thieves from their childhood, criminals on principle, who imbibed with their mother's milk the maxims of crime and the precepts of evil doing, who never heard aught of anything holy but in a curse or an oath, nor of anything sacred but in a sneer, nor of any social duty but in a scoff, nor of goodness but to be gainsayed, nor of benevolence but to be banned; here, I say, are young criminals caught like the young of wild animals, those pariahs of civilisation, outcasts of society, and then trained, regenerated, and disenthralled. Surely the Eastern tale, how the fountain of youth transformed the decrepitude of age and the wrinkles of the old into the vigour, strength, and beauty of the young, was not so strange as the moral renovation which is now taking place in those reformatories. But I much fear the greater the good they do, the more criminals they reform, the more felons they set up in life, the more likely is it that this great philanthropic movement will be brought to a stand-still; because, when once it becomes generally known that the old proverb, "Honesty is the best policy," no longer holds good, but is superseded by this other, "Thieving is the best policy," when you systematically reward and cherish the evil doer, while you treat with cold neglect the poor but honest child, when you nationally realise the sneer of the satirist, *virtus laudatur et alget*, praise virtue and let her starve; when the paupers of our crowded lanes and festering alleys shall hear how that good-for-nothing boy Tom Styles, who was tried at the Sessions, and found guilty, was sent to a reformatory, where he learned a trade, and is now a magnate in Australia, the owner of flocks and herds, dining off gold plate and faring sumptuously every day; why the police office will become the primary Institution of the country instead of the school-room; the jail gate will have more attractions than the church door, and men will seek to graduate in prisons as a preliminary to success in life, as the youth of the upper orders now do at a university. You will realise the old fable, every guilty head you cut off from the hydra crime will be replaced by seven others in its stead. Now, do not mistake me, I do not undervalue or make light of the great present good which the reformatory movement is effecting. The criminals are a fact, and as a fact they must be dealt with. All honour to those men who have put their hands to this great and good work. At the same time, I say without the shadow of a doubt on my mind, that the good will be turned into evil unless as much at least be done for the virtuous as for the vicious portion of society. My argument is briefly this, if education and industrial training can so thoroughly cleanse these who have been dragged through the mire of guilt and crime, how much more ought they to do for those who have never offended, whose habits have not been warped. It is easier to keep a tree straight than to make it grow from crooked to straight. But you will say, such an education as you refer to for the whole of our poorer population would entail an enormous expense. Look at the cost of our reformatories for a few hundred criminals. Extend this system of industrial training to the whole of our working classes, and who shall compute the cost? In reply to this objection, I say that the great principle which ought to under-lie every system of national education is this, that every healthy child should contribute a portion of his labour to defray, at least in part, the charge for his school instruction. Let him give value for what he receives. But some ready objector will reply, would you have a farm and workshop attached to every national school? would you propose that the child who is now six hours a day at school, and learns but little, should have his time still further curtailed? Now I venture to assert this, that a boy who alternates three hours' labour with three hours' learning, will make more progress than another who is shut up for the whole six hours in a school-room. This is one of the cases where three added to three do not make six, but sometimes the result is even less. This you will easily understand if you will recollect what I have striven to impress on you, that the amount of knowledge on a given subject which you can acquire, does not so much depend on the time you give to it, or on the clearness of your understanding, as on the amount of concentrated energy and vigorous attention you bring to bear upon it. But I cannot discuss this interesting question further; I have too far trespassed on your time and attention. And now, in conclusion, let me add, that the only supposition which gives strength and consistency to all I have been saying is this, that we have each of us our given work to do, our plain duty to perform. "Is there not an appointed time to man upon earth? are not his days also as the days of an hireling." Whatever we have to do let us do it with all our might, believing that one day or other we shall be called on to render an account of the talent placed in our hands. Were it otherwise, why should we not say with the Epicurean of old, "Let us eat and drink, for to-morrow we die." It is this consideration which is the ground of the striking difference between the Christian and the Heathen character; of the enduring energy and the firm purpose of the one, contrasted with the callous apathy and the reckless indifference of the other. Surely, if we believe that the vast Universe itself, with all its countless suns, and planetary groups, and wandering stars, and nebular wreaths of matter; that this huge solar system of ours, with all its orderly arrangements and harmonious laws; that the solid earth we tread upon, the heaving pulse of the ocean, the might of the tempest; that life in all its varied forms, down to the minutest creeping thing which eludes the sight, that the tiniest leaf, the thistle down, the gossamer web, that veils each shrub and spreads from spray to flower, all have their appointed place, their allotted part, their fitting use, in the grand economy of God's creation; surely, I say, we cannot imagine that man alone is to be the one exception. The loftiest mountains are the accumulated results of the ceaseless action of the meanest of living things which die unrecorded and forgotten. Shall we shrink from our task, who know "when we rest from our labours that our works shall follow us." Let us then follow the path that is open to every one of us, doing all the good that we can in our day and in our generation, developing those faculties with which God has endowed even the lowest of us, knowing that He has promised, "wisdom and knowledge shall be the stability of thy times, and the strength of salvation."

Home Correspondence.

EXAMINATIONS.

Sir,—Not many years ago, the division of classes in this country was into "educated and uneducated." To our shame be it spoken, the distinction was most unequivocal: the rich was not so distinguished from the poor, or the noble from the lowly born, as the man of education from him who had never known that advantage. Common consent declared it; ordinary expression proclaimed it. It is a happiness to believe that we shall in a few years be able to speak correctly of the "educated and uneducated classes."

Those who were presumed by their position in society to have been fitted for the employments they sought, will, from henceforth, have a test applied, which, whether perfect or imperfect, at least shows the determination of the public upon such questions. Whatever may be the faults of army examinations, Foreign Office competition, East Indian civil service rivalry (and we may mention them at some future period), at all events they are guarantees of some degree of fitness for the appointment. Examination is there, competition does exist, and lucrative and honourable employment is to be the reward of superior intelligence. But, in this great educational movement, it has been thought no less desirable that the friendless urchin of the national school should be instructed in what is supposed to be fitting to his future career, than that the junior ensign of her Majesty's —— foot should be capable of writing her Majesty's English without reference to a Johnson's dictionary; and Government inspection is doing for the one what public examination professes to do for the other.

We take these two classes to represent, as regards the present question, the two extremes of society—on the one hand, the workhouse-boy; on the other, the candidate for the army, navy, or the public offices of the country. The hedger and ditcher, the sheep or cowherd, the farm labourer; or the incipient general, admiral, or statesman. The country has at length demanded the proper education (we had better say *instruction*) of these classes, with a view to the peculiar object of each, and Government is employed in carrying it out as far as present opportunities will permit.

There is, however, a class of persons coming under neither of these two heads, to whom the promotion of education would be most important, and who must feel under the deepest obligation to the Society of Arts for the manner in which their case has been represented and considered. I mean the *mechanical and artistic population* of England—men who depend for subsistence, or at all events reputable subsistence, upon the exercise of peculiar intelligence. The proper *education* (*i.e.*, training) of the workhouse schoolboy should be generally as practical as possible, inasmuch as his life will deal with the stern realities of digging, ploughing, sowing, or reaping, cattle herding or milking, or farm labour in some of its numerous varieties; but the practical education of the mechanic or artizan (beyond a certain dexterity) is about the lowest part of his intellectual development. The thing that makes him valuable to his employer is the intelligence he exhibits in carrying out scientific views, in bringing to bear extraneous matter upon his legitimate work, or even in suggesting alterations and improvements in the details of his business. Towards the encouragement of such training the Society of Arts has taken the most important step.

It may be assumed that competitive examination is the only efficient method of testing the various powers of mind, or of discovering the value of previous education for its proper purpose. There attaches to the idea of examination, as a necessary consequence, either immediate reward or emolument of some kind, or an improved chance of obtaining the best employment. Present reward is neither a sufficient nor a legitimate motive to exertion. The chance of obtaining good employment, and honourable distinction in it, is. The great desideratum, therefore, should be, a "registered certificate;" and every endeavour should be used to induce the most influential firms in all our large manufacturing towns to recognise the certificate of the Society, and to give due preference to all persons distinguished by that mark of superior competency; and as I apprehend that it must be plain to all gentlemen engaged in arts, manufactures, or commerce, that their interests are bound up in the efficiency of their servants, I should imagine that but little difficulty would be met with on that score.

But the examinations themselves do appear to present very many difficulties; or rather, I should say, the extension of them over the country, so as to produce the fullest amount of good; bearing always in mind that the first object should be the general improvement of the working-man's condition and position, and the furtherance of art and manufacture, rather than the fostering of individual talent and excellence.

In all cases of this kind the funds at the disposal of the Society, or which can be calculated upon from other sources, are the first consideration; and if men are unable to do all the good they would, it is no less their duty to do all the good they can.

Much liberality has been displayed by the several donors of prizes for the successful candidates, but, as it really seems questionable how many are likely to have the opportunity of competing, unless some means of conveyance to the capital, and of subsistence while there, be discovered, it is surely no impertinent suggestion, that a portion of the prize money should be set apart, to meet some proportion of pecuniary assistance from the Institutions, or the persons themselves, for the expenses of the candidates during their stay in London. And, as one of the great objections on the part of masters and parents must ever be the temptations of a great city, I would add the hope that at *some future time* an arrangement may be entered into for the respectable boarding and lodging of such persons as are in no position to be otherwise provided for, during their four days' sojourn in the metropolis. This must be a matter for consideration at some future time. At present the great object of the Society seems likely to be realised only by limiting the number of their candidates for the London examination; and I would endeavour to carry it out in the following manner.

It seems quite clear that, for the present, young men of the class under discussion cannot present themselves in very large bodies, but that they may yet come in numbers sufficiently large to embarrass the Society, should any undertaking as to expenses be entered into by the Society. Pecuniary arrangements might, however, be entered into, if only a certain definite number were permitted to appear at the Society's rooms; and it would tend to increase the public confidence in their moral tone, as well as to deter the idle and dissolute from a London visit, if some such scheme as I have ventured to propose could hereafter be realised.

In the meantime, to secure only the attendance of such young men as are likely to do credit to themselves in an examination of high character, might it not be well to institute, by means of itinerant district examiners, of the Society's choosing, local preliminary examinations? Such gentlemen, by co-operating with provincial boards, listening to their opinions, and forming by previous examination as accurate an idea as possible of the candidates' merits, might easily select one or two, or even more (if desirable), from each district, to send up for the final examination by the central board. This plan, as it seems to me, would relieve the London examiners of much trouble, the parents of many young men of much anxiety, and would enable the Society to entertain the question of pecuniary assistance with much better hope of success. It would still be open for the victims of disappointed ambition or over-estimated talent, in the district examination, to avail themselves of the opportunity for further trial in London: only, be it understood, at their own expense.

Perhaps it is impossible for the Society, in its distribution of certificates, to enter upon the question of moral excellence. We must be content to take studious habit as the guarantee for general character. Yet I cannot but think that some sort of testimonial from teachers, lay or spiritual, might be made (without offence to any denomination of Christians) one of the conditions of the Society's certificate.

There are so many questions involved in this, as to the superiority of oral over written examination, or the reverse, as well as to the general nature of examination and its particular subjects, that I shall close this letter with the intention of troubling you further upon the subject at a future opportunity.

I am, &c.,
CHARLES CLARKE.

Esher, Sept. 23, 1856.

Proceedings of Institutions.

ROYSTON.—The recently published report of the "Exhibition of Objects Illustrative of Science and Art, and their Applications to Manufactures, Natural History, Archæology, &c," held at the Institute, states, that on Monday, 12th May, the Exhibition was opened, under the patronage of the Earl and Countess of Hardwicke, Lord and Lady Dacre, and the Rev. L. V. and Hon. Mrs. Harcourt, when a remarkable collection of natural and artistic objects was displayed throughout the new building and in the grounds. The exhibition was kept open twelve days, and the average number of visitors for each day was 578. Two evenings were specially devoted to mechanics and domestic servants; and two mornings to National, British, and other schools, and the attendance of these classes was great beyond expectation. Robert Hunt, Esq., F.R.S., delivered a lecture on the exhibition. On the 28th of May, after the exhibition, the committee gave a promenade concert, and on that occasion the Testimonial Clock from the members of the Institute was presented to the Honorary Secretary by the President. A sum of £200 was realised by the exhibition, which was devoted to the reduction of the building debt. The committee received many donations for the library, and the nucleus of a museum is now formed, which they hope will continually receive additions.—On Wednesday evening, the 15th inst., Adolphus Francis, Esq., (from London) gave a Dramatic Declamation from Sheridan Knowles's "Virginius."

YORK.—On Tuesday evening last, the Lord Mayor gave an address to the members and friends of the Institute of Popular Science and Literature, as a suitable introduction to the lectures of the winter session. His lordship said, "If we regard the tone and spirit of the British Court—if we notice the line of procedure now adopted by our most influential noblemen and greatest statesmen—if we contemplate the discoveries and events which are constantly occurring around us, with their manifest tendencies, we must, I think, feel strongly impressed that industry and science are daily advancing in importance, and will, year after year, exercise an increasing influence over the destinies of this nation and of the world. We must not look upon the Exhibition of 1851 as an isolated event, as merely a happy idea of a great prince, but we should also look upon it as an expression of the British empire and the age in which we live, as an event deeply significant as to recent progress and future development. In former times, the principal delights of courts were the tournament, the chase, the mimic fight, the review. The only honourable profession, anciently, was that of arms, though the advocate, and, in later times, the banker, were allowed to make some kind of approximation; but labour and industry were for the most part frowned upon and kept down in ignorance and degradation. The Cyclops, who were perhaps typical of mechanical labour, were placed by the ancient poets in caverns under ground, and Apollo was represented as having even made war upon them and slaughtered them. The fine arts seem often to have joined in treading down sturdy and honest labour, but a change has long been gradually taking place. Labour is being raised from his degradation—from being a mere drudge—and is becoming honourably associated with the fine arts and with science. It is of the utmost importance to this country, and the only means, humanly speaking, by which she can maintain her high position amongst the nations of the earth, that her labour and industry should be economised and directed by intelligence and science. Our vast wealth and boundless stores of coal and iron will, in these days of easy transit, be more for the benefit of other nations than our own, unless we avail ourselves of them by scientific labour and the best mechanical appliances. The notion that labour should be kept in ignorance is as absurd as if a master should wish to put out the eyes of his servant lest he should observe their physical resemblance to each other. Science is the enemy of tyranny, but she is the friend of authority and order. The prospects of this country were never more favourable and inspiring than at present, and the elevation of Mr. Strutt, while in the atmosphere of commerce, to the peerage, forms an era in the internal history of this country, which is of no ordinary significance. The last stigma is thus removed from commerce, and the laws and usages of England now proclaim—

> "Honour and shame from no condition rise;
> Act well your part—there all the honour lies."

Here perhaps I may be permitted a digression on the subject of labour. Many young men are inclined to suppose that a life of toil is degrading. They forget that labour is indispensable to the health of both body and mind. Most members of the aristocracy used to labour hard in galloping across the country after foxes, while they would have thought it very derogatory to their rank to turn their labour to any useful or profitable account. One surely has but to mention this in order to demonstrate its absurdity. Many young men are sighing for "Plenty of money and nothing to do," but they do not bear in mind that an idle man cannot be a happy man.

> "Absence of occupation is not rest,
> A mind quite vacant is a mind distress'd."
> "Life's cares are comforts, such by Heaven designed;
> He that has none must make them or be wretched.
> Cares are employment; and without employ
> The soul is on a rack; the rack of rest
> To souls most adverse; action all their joy."

The decree has gone forth as to man, "In the sweat of thy face shalt thou eat bread, till thou return unto the ground," and none can escape this without incurring a heavier penalty.

> "Come hither ye that press your beds of down
> And sleep not; see him sweating o'er his bread
> Before he eats it—'tis the primal curse,
> But soften'd into mercy; made the pledge
> Of cheerful days and nights without a groan."

Show me a man who does not labour, either with his head or his hands, and no matter what his rank or possessions, you present to me a great sufferer. If he render no service to his fellow man—if, having the ability and opportunity, he add nothing by his own exertion to the common store, he is but an incumberer of God's earth—a species of locust, and the world will have no reason to lament when he is consigned to his grave. For my own part, I should feel on better terms with my own reflections to break stones by the side of the high road than to eat the bread of idleness, and consume the products of the earth, without contributing some service in return. The soldier is not careful to conceal the scars which he has honourably received in the service of his country, and let not honest labour be ashamed of his horny hand and brawny arm. In olden times, Vulcan is represented as an unsuccessful suitor to Minerva, but in modern times we may hope to see labour and science indissolubly united, and exercising a benign and mighty influence over the destinies of mankind. Let no young man despise an honest vocation, because it involves manual labour; neither let him cast an envious eye towards the learned professions, or towards any occupation almost exclusively intellectual. The balance of advantages and disadvantages in each position is so nearly equal, that it depends for the most part upon the individuals themselves, as to which position is the most conducive to a comfortable and useful, and, we may also add, an honourable life. If the body have not sufficient exercise, intellectual employment is feverish, and enfeebling to the general character, while, on the other hand, manual labour is too often accompanied with almost a total torpor of the mental faculties. The world is fast opening its eyes to much of its folly and injustice in these respects, though in China, I am told that even yet (and many of you will at once understand why this particular instance should readily occur to my recollection), those who are engaged in the preparing of the skins and hides of animals, are cut off, as if leprous, from the rest of society, and are treated as the scum and offscouring of all things; but in this country, anything like a ban upon any species of honest, useful labour is fast disappearing. The sooner it wholly disappears, and the more intellectual and corporeal labour are interwoven, the better. A life of active employment, with a moderate amount of leisure for mental cultivation is perhaps, upon the whole, the most favourable for strength of body and mind, and for general usefulness of character. Let no one lament that he cannot devote the whole day to literary studies. *Sit nihil nimium* Most of us have sufficient leisure for as much as we can well digest. Even the most gifted must be content to be ignorant of very many things; and the higher we rise in attainments, the more extensive will be our view of what remains unexplored by us. A little learning is good, unquestionably good, as far as it goes, if it do not make us fancy we know a great deal. If we are disposed and are trained to cultivate our mental faculities, and if we are observant, for it is the old case of "eyes and no eyes," we shall find that the men and things we meet with in the most ordinary walks of life are fraught quite as much as books with important data for mental exercise and information. The knowledge we gather from books is in some respects second-hand; while what we pluck for ourselves by our own observation is fresh and unadulterated, though there is of course much knowledge which is quite out of our reach except through books. It should never be forgotten that the paramount object of our literary and scientific pursuits should be to fit us for a more efficient discharge of the duties connected with our particular calling, and the position generally which we occupy; and he who allows himself to be drawn away into a neglect of that by which he obtains his bread, is following an ignis fatuus, which, in all probability, will, sooner or later, lead him into sorrow and disgrace. The surest and shortest way for any man to competence and eminence is to attend well to that vocation upon which he directly depends for obtaining a livelihood, and for his position in society. Before making this long digression, I was referring to the growing importance and increasing influence of labour and science in this country. Improvements cannot rise much higher than the general intelligence of the masses of the people. Most of us can call to mind how the introduction of machinery into manufactures was encountered with the most inveterate prejudice, and with alarming demonstrations of violence. If that opposition had been permanently successful, it would have been suicidal—it would have been fatal to the well-being of this country. The president of the Association of Mechanical Engineers mentioned a few days ago, at Glasgow, that in spinning fine numbers of yarn a single workman on a self-acting mule can now do the work of 3,000 hand spinners with the distaff and spindle, and that in the manufacture of lace one man with a machine can now do the work of 8,000 lace-makers on the old principle. Thirty years ago, the labour of trueing a surface of cast iron by hand labour was 12s. per foot; but now, by the planing machine, this can be accomplished at a cost of less than 1d. These are not exceptional cases; "*Ex uno disce omnia*:" they are but specimens of the marvellous advances which have been made in almost every department of chymical and mechanical action. The power-loom, the self-acting mule, the thrashing machine, the locomotive, the electric telegraph—which will soon belt the world with its lightning zone, Bessemer's process of converting the worst iron into the purest malleable iron and steel, and so on, are perhaps but mere fragments of what we may anticipate from a wider diffusion of scientific light and instruction. I may perhaps here stay a moment to instance, that by Bessemer's simple invention of introducing a stream of atmospheric air in supersession of the puddling process, which is conducted by men nearly naked, on account of their broiling position, and looking like demons, millions of pounds sterling will be annually saved to this country. The cost per ton of bar iron will be reduced from £8 10s. to £6, and of steel from £20 to £6. Science smiles at the opposition of mere brute force, and either, like Jackson, causes an army of hostile influences to destroy one another, or, like a magician, paralyses and withers with a glance. War, and agriculture, and trade must alike visit with increasing assiduity the laboratory and the smithy for the weapons with which to subdue and to triumph. As knowledge increases, we may also expect the people generally to become more alive to the importance of cleanliness, of ventilation, and of drainage. What a field is thus opened to our contemplation, and what incentives there are to an increased and general cultivation of scientific pursuits. It is admitted on all hands that Mechanics' Institutes have greatly contributed to the improving aspect of the times. It was only in the year 1823, little more than thirty years ago, that through the exertions of Dr. George Birkbeck and others, the foundation of the London Mechanics' Institute was laid, but since then the number of Institutes and kindred associations throughout England, Wales, Scotland, and Ireland has reached a total exceeding eight hundred, with every prospect of a further augmentation. It is true that Institutes have been greatly dependant for their support upon the higher classes, and they have not sufficiently reached the classes for which they were in the first instance chiefly designed. But we have reason to be thankful for what they have accomplished, and it is to be hoped that, by and by, they will accomplish much more. Most of us, I have no doubt, are prepared to subscribe to the important declaration, made by Lord Stanley, a few days ago, at Oldham, in Lancashire. "The establishment of an athenæum, a lyceum, an institute, call it which you will, in every large town of England, is no longer a mere luxury which may be enjoyed or dispensed with at pleasure, but has become an essential and integral part of our social organization. I know all that has been, and may be, said against these institutions; and it is possible that their actual results may disappoint unreasonable expectations on the one hand, as they have dispelled unworthy fears on the other. But I deny in toto what is sometimes affirmed—that the experiment of their establishment has been hitherto a failure." Allow me to congratulate you upon the present condition and prospects of the York Institute. Your numbers have been higher previously than they were last year, but still the course of this institute from its commencement in an humble building in Bedern, in the year 1827, and from the erection of this hall, in 1846, must have been highly satisfactory and encouraging to its promoters. I confess, I have considerable expectations from the session upon which we have entered. At their first meeting a few days ago, the committee mustered in greater numbers to open the campaign, than I have before witnessed. You will have noticed the very attractive list of of lectures, but I would lay the principal stress upon the new arrangements as to the classes, for, after all, it is there where the substantial work of institutional training and education is to be accomplished. I trust that the young men of this city will avail themselves of this rare opportunity of tuition under gentlemen of such eminence, and I trust that there will be an adequate response, and that this will be a new and important epoch in the history of this institute. If this happily be the case, I hope to live to tell you to whom you are principally indebted for it. The Society of Arts, under the presidency of his Royal Highness Prince Albert, and comprising amongst its officers some of the most eminent of our nobility and literati, has decided to hold a provincial examination, next June, of candidates from the northern institutions in connexion with that Society, and we had some ground for hoping that such an examination would be held at York. Our exertions, however, in favour of York have been countervailed by the pressure of the Yorkshire Union of Institutes in favour of Huddersfield, where their annual meeting is to be held next year; and the Council of the Society of Arts have informed me, through their secretary, that on this account chiefly, *though with reluctance*, they have on this occasion passed us by. I ought perhaps here to mention, to the great credit of the Huddersfield Institute, the very large number of efficient classes connected with it, which are greatly sustained by the masters of the college there. The subjects of examination will be all or any of the following:—Mathematics, mechanics, chemistry, physiology, botany, agriculture, geography, English history, English literature, English composition, writing from dictation, Roman history, Latin, French, German, and free-hand drawing in outline from objects. The prizes are, one of 25 guineas, and various sums of 10 guineas, and also certificates of honour, which will be carefully registered so as to be available as testimonials of much greater weight than any private recommendation, and there are also two government appointments that will be awarded as prizes. I hope that in some of the departments, if not next year, at all events when an examination is held here, some York candidates will obtain an honourable position, but if they only try they will assuredly reap an adequate though it may be an indirect reward, like the young men in the fable, that ploughed deep their father's estate, in the expectation of finding a hidden bag of gold. There is another topic to which I would for a few moments invite your attention, but there is not time now for more than a passing glance. The other sex have not availed themselves of this institute to so great an extent as they have of a few institutes in other places. We were referred, a few evenings ago, to Mr. Prentiss' account of the praiseworthy conduct of a number of mill girls, with not large wages, at Lowell, in America, and our attention was called to the surprising number of churches, and ministers, and literary advantages which they have secured, without much self-denial, through their own judicious combination. I am glad that the importance of female training and education is more deeply felt than it has been, and that this subject is now receiving great consideration in high and influential quarters. Whether the advantages of these institutions, beyond the library and lecture hall, can be greatly extended in this direction, or whether separate institutions would be preferable, is a question upon which I will not now enter. Much would probably depend upon the special arrangements that could be made and the special circumstances in each locality. We cannot easily overrate the importance of elevating and strengthening the female character with scientific and literary information. In my humble judgment, a female cannot be too much "a blue stocking," provided she is also well versed in the useful common things of life. I need not expatiate upon the mighty influence for good or ill which sisters, and wives, and mothers exercise; and a very cursory glance at history is sufficient to satisfy us of the truth which is couched under the poet's question, "Can man be free where woman is a slave?" While, however, we extol mental culture, we must not forget that the kitchen is as much a part of feminine dominion as the drawing-room, and a kitchen out of order is as uncomfortable to a household as a stomach out of order is to the human frame. Even those who are above the humbler classes, are ill prepared for the duties and vicissitudes of life if they have only accomplishments, and are not practically acquainted with culinary affairs, with the making and mending of articles of clothing, and with the common useful things of every-day domestic life. In hastening onwards, a suggestion occurs to me which is, perhaps, not undeserving of further consideration. The Yorkshire Philosophical Society, the School of Design, and some other associations in this city, have many objects in view which are kindred to those of this Institute, and perhaps a further combination or union is practicable, by which greater strength may be obtained and the common end more economically and effectually accomplished. The Public Libraries' Act, 1850, may also, by and by, be a useful ally in carrying on the work of popular instruction. I now approach the last particular topic to which I shall at present advert. Mechanics' Institutes are often impeded and greatly checked in their range by having to teach some of their members the simplest rudiments of knowledge, such as reading and writing; and those who are the most destitute and ignorant have the least desire for information and instruction. Mechanics' Institutes take rank amongst the educational agencies of the nation, and following a high authority on a recent occasion similar to this, I venture to offer a few observation upon one of the most agitated questions of the present day. The difficulty in that question is the religious element. Too many are determined that if they cannot obtain the kind of spiritual education which they think orthodox, that the masses shall not have even mental education. Why not obtain all the education we can, and make that portion compulsory upon all as to which we are all agreed? But many would reply that if you educate without religion, you merely augment the power of doing mischief. Upon such a principle as this you might say (though no one can be more in favour of religious education than I am), if we find a family sickly and manifestly suffering under the influence of bad drainage and imperfect ventilation, we must on no account administer any relief without religious inquiries and provisions. A healthy heretic will do more mischief than a sickly one. I state the argument, and I need not multiply instances to illustrate it. If a certain portion of our clergy and ministers would lay aside their unsound apprehensions and jealousies we might at once have education universal in this country—we might at once bring our wide, waste-howling deserts of mind into magnificent cultivation. I need not travel beyond our institutes for a confirmation of their views. Where would they have been if their founders had waited for either political or religious uniformity? We interdict all party politics and controversial theology as the least of two evils, and yet we are not traitors either to our country or to our God. With Wordsworth I would say—

> "Oh! for the coming of that glorious time
> When, prizing knowledge as her noblest wealth
> And best protection, this imperial realm,
> While she exacts allegiance, shall admit
> An obligation on her part to teach
> Those who are born to serve her and obey."

In closing this address, I would say to the young men of tihs Institute, read novels as cautiously as you would take fermented liquors. Real actions and occurrences are the fresh, living water. Cultivate your minds—take care of God's noblest temple, the body—covet earnestly the best gifts, those spiritual, unfading gifts, which are denied to none who truly seek them—guard scrupulously the Lord's day—and overlook not earth and Heaven's Magna Charta, the Bible. Ascertain carefully the path of duty, and tread it fearlessly and perseveringly, through good report and through evil report. "Fling away ambition." Grasp not at fame. "Avarice of fame," says Byron, "is avarice of air." Grasp not at fame, worth's shadow, but secure the substance. Be not ashamed of a humble parentage, or a humble occupation. Be not ashamed of poverty, or even of a small amount of natural endowments, lest you should thereby reproach the King of Kings; but be ashamed of misspent time and misdirected talents. Be always ashamed of vice. A wicked man cannot be truly brave or noble.

> "Thus oft it haps that when within
> They shrink at sense of secret sin,
> A feather daunts the brave;
> A fool's wild speech confounds the wise,
> And proudest princes veil their eyes
> Before the meanest slave."

Finally, in the words of our own immortal dramatic bard,

> "Let all the ends thou aims't at
> Be thy country's, thy God's, and truth's."

—The Rev. H. V. Palmer, in complimentary terms, proposed a cordial vote of thanks to the Lord Mayor, for his valuable address, and suggested that his lordship should give his permission to have it printed.—T. S. Noble, Esq., seconded the motion, which was passed with acclamation.—The Lord Mayor returned thanks, and the company then separated.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October* 17*th*, 1856.]

Dated 26*th August*, 1856.

1992. Alfred Vincent Newton, 66, Chancery-lane—An improvement in breech-loading cannons and other ordnance. (A communication.)

Dated 1*st October*, 1856.

2292. George Flint, Skinner-street, Bishopsgate Without, Thomas Wood and Edward Wood, Tachbrook-street, Pimlico—An improved punching press or machine, adapted to the purposes of stamping, coining, slotting, and embossing, and for cutting metal and other substances.

2294. John Holman, Western Clubs, Topsham—Improvements in ships' rudders.

2296. Henry Naylor, Bacup, Warper, and James Crabtree, Rochdale—Improvements in and applicable to machines, commonly known as "warping mills."

2298. Alfred Vincent Newton, 66, Chancery-lane—Certain improvements in sewing machinery. (A communication.)

2300. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvements in stoves and apparatus for heating or warming greenhouses, which may also be used for other warming or heating purposes. (A communication.)

2302. David Jones, Greenhill-villa, Ragland, Monmouthshire—Certain improvements in obtaining and applying motive power.

Dated 2*nd October*, 1856.

2306. James Whitehead, Dukinfield, Cheshire—Certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

2308. Victor Renault, Bordeaux—Improvements in regulating and directing the steam escaping from the cylinders of locomotive engines.

2310. Henry John Distin, 31, Cranbourne-street, Leicester-square—Improvements in the means of regulating the tone of kettle drums. (A communication.)

Dated 3*rd October*, 1856.

2314. John Hopkins, 5, Lower Oxford-street, Whitechapel—Improvements in the construction of furnaces.

2318. Lemuel Wellman Wright, Sydenham—Improvements in gas meters.

2320. David Ogilvy Boyd, 78, Welbeck-street—Improvements in constructing and arranging smoke and air flues.

2322. Richard Archibald Brooman, 166, Fleet-street—An improved lathe or tool suitable for turning, drilling, boring, planing, and smoothening, also for grooving, morticing, and slotting, parts of which tool may be applied to lathes generally. (A communication.)

2324. Robert and James Haslam, Preston, Lancashire—Improvements in looms for weaving.

2326. Charles Durand Gardissal, 10, Bedford-street, Strand—Improvements in the manufacture of cement. (A communication.)

Dated 4*th October*, 1856.

2328. Alfred Vincent Newton, 66, Chancery-lane—Improvements in supplying steam-boilers with water. (A communication.)

2330. Maria Farina, Hanway-street, Oxford-street—An improved tooth powder. (A communication.)

Dated 6*th October*, 1856.

2332. John Silvester, Woolwich—Improvements in the application of steam or air in the production of motive power.

WEEKLY LIST OF PATENTS SEALED.

Sealed October 17*th*, 1856.

928. Uriah Scott.
930. Thomas Walker.
932. Julius Jeffreys.
938. Edmund Hunt.
939. Chas. Frederick Stansbury.
940. William Adkins.
960. Alfred Vincent Newton.
964. David Lloyd.
969. Frank William Blacket.
993. James Hardacre.
1017. Thomas Webster Rammell.
1049. Robert Tolmie Campbell.
1059. Alfred Chadburn.
1063. John Wright.
1081. James Gray Lawrie.
1120. William Edward Newton.
1182. George Clark.
1647. William Bridges Adams.
2033. Lazarus Simon Magnus.

Sealed October 21*st*, 1856.

955. William James Cantelo.
967. William George Armstrong.
970. George Forster.
972. James Garnett.
974. Thomas Squire and Charles Frederick Claus.
975. John Shae Perring.
1014. James Stead Crosland.
1019. William Pilling.
1021. John Smith and William Craven.
1028. Nathan Defries and George Henry Bachhoffner.
1029. Henry Mapple.
1036. Nathaniel Smith.
1074. Jean Périnaud.
1075. Robert Royds.
1119. William Edward Newton.
1128. William Edward Newton.
1196. Alfred Vincent Newton.
1264. John Harris Heal.
1335. Rd. Archibald Brooman.
1368. William Edward Wiley.
1616. William Bridges Adams.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

October 16*th*.

2399. George Louis Stocks.

October 17*th*.

2388. George Frederick Chantrell.
2436. Jean François Felix Challeton.
2455. Thomas Summerfield.

October 8*th*.

2436. Pierre Marie Fouque, Louis René Hébert, and Vincent Etienne Doret le Marner.

Journal of the Society of Arts.

FRIDAY, OCTOBER 31, 1856.

MEETING OF COUNCIL.

October 29, 1856.

On the recommendation of the Board of Examiners, the Council have passed the following minute with respect to those Institutions which may claim to avail themselves of the Society's Examinations :—

"I. That the Mechanics' Institutions, Societies, Trade and other Schools, in Union with the Society of Arts, in London and in the country, be invited to form themselves into groups, with a view to the establishment of Local Boards of Examiners.

"II. That the Managers shall endeavour to obtain the assistance of qualified persons to act as Examiners.

"III. That the Local Boards when so chosen shall elect a Chairman and Honorary Secretary, who shall place themselves in communication with the Society's Board in London, so as to secure unity of action and uniformity of procedure.

"IV. That the Local Boards shall hold their Examinations in the month of March.

"V. That as soon after as may be, the Local Boards shall report to the Society's Board the results of the Examinations, the numbers of candidates who are to be sent up to the Society's Examinations in June, and the subjects in which such candidates are to be examined.

"VI. That in the month of July the Local Boards of Examiners shall call public meetings in their respective localities, and deliver, in the presence of their friends, neighbours, and fellow-townsmen, to the successful Candidates, the Society's Certificates and Awards of Prizes, previously sent down from the Society of Arts to be so distributed."

THE EXAMINATION HELD IN JUNE, 1856.

The Dean of Hereford has presented to each of the candidates who obtained a Certificate at the Examination held in June last, a copy of a work edited by himself, entitled, "Lessons on the Phenomena of Industrial Life."

SOULAGE COLLECTION.

It having been represented to the Council, that Mons. Soulage, of Toulouse, was possessed of a very valuable and extensive collection of mediæval furniture and objects of *vertù* illustrative of art in Italy in the middle ages, and that he was prepared to sell it in one lot for eleven thousand pounds, and a very favourable report in reference to the collection having been made by Mr. John Webb, extracts of which are given below; the Council were of opinion that it was very desirable that the collection should be secured for the benefit of art in England, and they have, therefore, joined with a number of individuals in entering into a guarantee fund to enable the purchase to be made. The funds for the purchase have been borrowed on this guarantee, and the purchase has been made. The collection has arrived in England, and will very shortly be publicly exhibited, and public opinion taken on its merits, previously to the government being asked to purchase it for the nation. If the government decline to purchase the collection, it will be sold in the manner most advantageous for the interest of the guarantees. In the event of any loss, which there is no reason to anticipate, the guarrantees will only be liable for their share in proportion to the amounts for which they have given their names. The following is a list of the names of parties who have joined in the guarantee, and the amounts for which they deem themselves responsible.

E. Marjoribanks (Messrs. Coutts)	£1000
The Earl Granville, 16, Bruton-street	500
The Lord Ashburton, Bath-house, Piccadilly	1000
H. Minton, of Stoke	1000
Edward Wood, of Burslem	1000
Robert Napier, of Glasgow	500
W. Maskell, 9, Victoria-square, Clifton	500
M. Uzielli, Hanover Lodge, Regent's-park	1000
Philip Miles, of Bristol	100
Dr. Lyon Playfair, C.B.	300
Richard Redgrave, R.A.	200
Henry Cole, C.B.	300
J. Mayer, Liverpool	100
H. T. Hope, Deepdene, Dorking	1000
J. C. Robinson (Marlborough-house)	100
F. Fowke, Capt., R.E.	200
W. Ewart, M.P., 6, Cambridge-square, Hyde-park	100
R. Burchett (Marlborough-house)	100
H. Farrer, F.S.A., 15, Albert-road, Regent's-park	500
C. Sackville Bale, 71, Cambridge-terrace, Hyde-park	100
W. Chaffers, F.S.A., 14, Grafton-street, Bond-street	250
A. Barker, 103, Piccadilly	500
Richard Fisher, 35, Queen-square, Bloomsbury	100
J. Swaby, 13, Torriano-terrace, Kentish-town	200
John Webb, 11, Grafton-street, Bond-street	500
Holland and Sons, 23, Mount-street	500
Artists, Carvers, and Workmen in the employ of Messrs. Holland and Sons	100
Alfred Lapworth and Co., 22, Old Bond-street	200
John Jackson, 49, Rathbone-place	300
W. B. Simpson, 456, Strand	100
George Trollope and Sons, Parliament-street	250
Jackson and Graham, 38, Oxford-street	500
John Crace, 14, Wigmore-street	300
J. Sheepshanks, Rutland-gate	200
G. R. Elkington, Birmingham	300
J. Jobson Smith, Sheffield	100
Thomas De la Rue Warren De la Rue, F.R.S. } Bunhill Row	500
Gillow and Co., 176, Oxford-street	500
R. Phillips, 23, Cockspur-street	200
S. C. Hall, 21, Ashley-place, Victoria-street	100
Dudley C. Marjoribanks, M.P., 29, Upper Brook-street	500
Sir Francis E. Scott, Bart., Great Barr Hall, Birmingham	100
George Godwin, F.R.S., 24, Alexander-square, Old Brompton	100
Henry G. Bohn, Twickenham	200
G. Gilbert Scott, 20, Spring-gardens	100
George J. Morant, 91, Bond-street	250
I. K. Brunel, F.R.S., 18, Duke-street, Westminster	500
Sidney Smirke, A.R.A., 79, Grosvenor-street	500
Johnstone and Jeanes, 67, New Bond-street	500
His Grace the Duke of Hamilton and Brandon, Arlington-st.	500
Robert S. Holford, Dorchester-house, Park-lane	300
Christie and Manson, 8, King-street, St. James's	250
John Dunn Gardner, 113, Eaton-square	200
Joseph Clarke, 13, Stratford-place	100
Owen Jones, 9, Argyll-place	100
R. J. Spiers, 14, St. Giles's-street, Oxford	100
Hanson and Wright, 16, John-street, Oxford-street	100
Hunt and Roskell, 156, New Bond-street	300
Council of the Society of Arts, per P. Le Neve Foster, Secretary	500
J. J. Mechi, Tiptree-hall, Kelvedon	100
Joseph Rodgers and Sons, Sheffield	100
James Dixon and Sons, Sheffield	100
Mappin, Brothers, Sheffield	100
Sir Henry Meux, Bart., M.P., 41, Upper Brook-street	500
Sir John Marjoribanks, Bart., Lees, near Coldstream	200
Thomas Miller Whitehead, 8, Duke-street, St. James's	100
Titus Salt, Saltaire, Bradford	1000
J. W. Fraser, 8A, Kensington-palace-gardens	200
C. Drury E. Fortnum, Stanmore-hill, Middlesex	200
W. Wilson Saunders, Wandsworth	100
Edward Chapman, 193, Piccadilly	100
	£23,300

Extracts from Mr. Webb's Report.

"The collection of mediæval furniture, bronzes, &c. &c., belonging to M. Soulage, at Toulouse, is of very considerable importance and magnitude, being composed of 865 various objects. It has the great interest attached to it of having been got together with a view to illustrate the domestic usages of the middle ages. The principal pieces are of a first-rate character and importance, not only in point of quality as works of art, but also in many cases from having belonged to personages of historical note.

"I would specify the grand chimney piece, in fine stone, sculptured by the brothers Lombardi; the magnificent lanthorn, executed in carved wood for the palace of the Doge Gradenigo; the tall and matchless fire-dogs, in bronze; also the smaller ones, from the Brancaleoni palace; the fine bronze candlesticks of exquisite workmanship; the magnificent knocker in bronze, by John of Bologna; the carved furniture, comprising chairs of the rarest and most interesting forms; the richly carved cabinets, armoires, buffets, tables, &c., &c. The Raffaelle-ware is very conspicuous and important in this collection, comprising specimens of most of the celebrated potteries of Italy; amongst them will be found no less than 52 plates and dishes attributed to Maestro Georgio; one quite unique and of great value, representing the portrait of Perugino, after a drawing said to have been furnished by Raphael to the fabric at Urbino; also various interesting vases and cups of the same character, one of which is of the rarest beauty. The Limoges enamels, although not numerous, have amongst them two portraits of high value. The Italian medals, representing the celebrated personages of the renaissance, are replete with beauty and interest. Among the 'orfévrerie' is a piece reputed to be from the design of Michael Angelo; besides many others equally interesting.

"The Palissy ware, though confined to a few specimens, boasts of a ewer or vase remarkable for its finish, beauty, and colour, and the like is not now to be met with. In every other section, indeed, there is something to mark a superior character to anything that can be obtained at the present moment.

"Taking, therefore, the quality of most of the objects, their great interest in bearing the arms, crests, and monograms of the various remarkable and great persons to whom they appertained, the collection possesses a consequence which I have no fear of overstating, especially when, as at present, the Continent of Europe is being traversed by amateurs, dealers, and others, all anxious to secure everything that has pretensions to art or history, offering very high prices (which are daily augmenting) as the only means of tempting the possessors to part with their specimens.

"I have based my valuation in a certain degree on present prices, because most high and tempting offers have already been made to M. Soulage for many of the objects; and, I believe, that if this collection were to be submitted to public competition, so great would be the desire to possess many or most of the articles, that many wealthy persons to whom it is well known would bid with a determination to purchase, and the product of the sale would arrive at a much higher point than might otherwise be anticipated, an event now of very frequent occurrence."

Here follows a detailed statement of the collection, with an estimate of its value, which Mr. Webb recapitulates as below:—

"1. Richly carved furniture	£2,888	0	0
2. Bronzes	1,785	0	0
3. Orfévrerie and fine metal work ...	351	0	0
4. Raffaelle ware, plates, &c.	1,980	0	0
5. „ vases, &c.	870	0	0
6. Palissy ware and other French faience	439	0	0
7. Flemish pottery, &c.	40	0	0
8. Venetian glass and large chandelier	508	0	0
9. Various objects	148	0	0
10. Limoge enamels	573	0	0
11. Ivories, &c.	60	0	0
12. Lucca della Robbia ware	80	0	0
13. Sculpture in marble, stone, &c. ...	620	0	0
14. Medals	380	0	0
15. Stained glass	120	0	0
16. Pictures	560	0	0
17. Stuffs and embroideries	180	0	0
18. Addenda, various, as per letter ...	200	0	0
	£11,782	0	0

"Having thoroughly gone through and estimated this collection, I beg to inform you, that I consider it in every way worthy of your consideration, and I can most confidently recommend the purchase of it for a public museum. I also venture to assert, that it is one of the very few opportunities that occur to possess a collection of mediæval art, and trust it will be considered too rare and valuable to be lost sight of. It remains for me to state, that M. Soulage offers the collection complete for the sum of £11,000."

THE BRUSSELS ECONOMIC EXHIBITION.

Report, by T. Twining, Jun.

The Council are aware that, at the Philanthropic Conferences held at Paris, in July, 1855, a resolution was adopted recommending the formation, in various countries, of collections of articles of domestic and sanitary economy for the use of the working classes, according to the plan set forth in my memorandum, published under the auspices of the Society of Arts, and that a committee was appointed for organizing such a collection, as an annexe or supplement to the Universal Exhibition.

The *Galerie d'Economie Domestique*, thanks to imperial patronage, to the friendly assistance of M. Le Play, the Commissioner-General of the Great Exhibition, and to the indefatigable labours of the gentlemen who formed the Special Commission, was as complete and well-arranged as the limited time would allow; but it could, of course, only aspire to be a first step in a new line of practical benevolence.

M. Ducpetiaux, the eminent Belgian philanthropist, to whom the Paris Congress entrusted the care of organizing at Brussels the Congress of 1856, resolved to take a step further in the Economic movement, by inviting, in due time, the manufacturers of Belgium, and the other European countries, to send specimens of articles of every kind calculated to improve the physical and intellectual condition of the industrious classes, to an Exhibition to be held, from the 25th of August to the beginning of October, in the Conservatories of the Royal Botanic Gardens, at Brussels.

I am happy to say that the appeal, supported by the liberal patronage of the Belgian Government, was satisfactorily responded to by the Belgian producers, and that several other countries were well represented.

It had been supposed that English manufacturers, who had grown rather tired of Exhibitions, would not have taken an interest in this; but, thanks to the furtherance afforded by the Society of Arts, and to the zeal of the agents appointed for England, Messrs. Mertens, Trupel, and Co., I had the satisfaction of seeing a considerable number of English contributors. This is confirmed by the fact, that of the distribution of prizes which took place, with much ceremony, at the Hotel de Ville, on the 20th of September, under the presidency of H. R. H. the Duke of Brabant, no less than eleven medals were awarded to English exhibitors.

The spacious conservatories where the Exhibition was held were very well adapted for the arrangement and display of the articles, though they did not allow of their being placed strictly according to the classification adopted in the programme and in the Exhibition Catalogue, viz.,

I. Plans, models, materials, and the various processes connected with building.
II. Furniture and household utensils.
III. Clothing and linen.
IV. Food, and the various processes involved in its preparation.
V. Tools and instruments for handicraft occupations, both industrial and agricultural.
VI. Worship, physical and moral education, instruction, recreation.

On the right-hand side, upon entering the first and largest of the halls, was a very complete and attractive collection of educational appliances, got together under the special care of Messrs. Braun and Ducpetiaux, under whose joint names it was exhibited. Here I was pleased to see that the educational diagrams of Mr. Reynolds, of 174, Strand, made a very good appearance, and seemed to be duly prized.

A large portion of the hall was appropriated to linen and clothing, among which some articles of British produce were noticed for their extreme cheapness.

Near the centre was a very interesting collection of models, dressed in the baby-linen used by the poor in Belgium, France, England, Denmark, Germany, Austria, Switzerland, and Italy. Not far thence was a figure representing the ordinary costume of a Belgian workman. It comprised cap, shirt, trousers, woollen socks, nailed shoes, braces, neck-kerchief, waistcoat, and blouse. The whole to be had for the almost incredibly low amount of twelve francs, somewhat less than ten shillings. I should mention that throughout the Exhibition the price was appended to each article, and that a special officer was appointed to give to visitors every facility for purchasing the goods (to be delivered at the close of the Exhibition), or for giving orders to the respective manufacturers. As an instance of the beneficial tendency of thus enabling the members of the International Philanthropic Congress to take home to their respective countries the goods most suited to the local requirements, I may mention, that M. Viande Patry came to Brussels provided with a considerable sum, which he and his friends had collected for purchases intended to form the nucleus of an Economic Museum in Geneva. I myself experienced the greatest courtesy from M. Piret, the Director of Sales, who, having received special instructions from M. Ducpetiaux, undertook to get together, and to despatch to England, such things as I might require for the Economic Museum which I am forming in the name of the Council.

Many articles were presented as donations. Thus, Professor Guido Susani gave me a selection from the very complete and interesting collection of articles illustrating the apparel, utensils, occupations, and resources of the Lombardy peasantry, which had been formed with great care by the Milanese Society for the Encouragement of Arts and Manufactures, and which he had brought to Brussels at very considerable expense: I am told, no less than 1,200 francs.

The Second Hall, in the form of a lofty rotunda, was chiefly occupied by stoves, bedsteads, earthenware, and other articles of household furniture.

Here I noticed, and ordered for England, some cheap, and well-contrived cooking-stoves, and a hammock bed, used at one of the Belgian Reformatory Schools.

The Third Hall, which was a long narrow gallery, was nearly filled with a variety of tools used in the more common branches of industry, and with an assortment of agricultural implements. These collections would perhaps not be admitted into an economic exhibition in England; but it must be remembered, with regard to agricultural appliances in particular, that on the Continent land is much more subdivided than with us, and that even among the poorer classes of the peasantry, numbers are the proprietors of the land they till, and must be trained to a judicious appreciation of agricultural appliances; whereas in England the organization of husbandry is essentially different, and the labourer is trained to be himself a living tool.

Alimentary substances occupied about one-half of the Fourth Hall. This collection, though very interesting, presented perhaps a less satisfactory *ensemble* than other departments; there were some notable deficiencies, whilst, on the contrary, some series were carried out to an extent beyond the requirements of an economic exhibition.

The other half of the Hall was taken up by a department which, though last in succession, was first in the catalogue, and certainly second to none in importance—that of architectural designs and appliances.

I may be allowed to borrow from the *Builder*, of the 4th instant, an account of this department of the Exhibition, furnished by Mr. H. Roberts, the Honorary Architect of the Labourers' Friend Society :—

"The principal place in the Exhibition was occupied by specimens relating to the construction and furnishing of dwellings. It is curious to note the various steps taken in Belgium for the improvement of the dwellings of the labouring classes. The Hygienic Congress of 1852 had given much of its time to the sanitary amelioration of populous districts, and it laid down a series of resolutions on the subject. In these, rules for the building of habitations for the working classes and poor were published. This subject was taken up by the 'Conseil Supérieur d'Hygiène Publique' in two reports, where the means to put into execution the resolutions of the Congress were explained. Ultimately, the 'Commission Permanente des Sociétés de Secours Mutuel' examined the question, and issued a report.

"In France, a credit of six millions of francs was obtained, in 1852, towards the erection of dwellings for the workmen in the large manufacturing towns. Thus, *cites ouvrieres* have been erected in Paris, Marseilles, Lille, and other places. Still, it was the exhibition of the models of the private Society of Mulhouse (Département du Bas Rhin) which attracted most notice in Brussels. The whole capital of this Company was only 350,000 francs (£14,000), but it had a man like Müller, the architect, who supplied the deficiency by integrity and talent. The houses of the Mulhouse Society have each a garden. The French workmen can pay the rent according to a very varied scale, and become even *proprietors*. In the year 1855 the Society possessed 186 houses, of which sixty-five had been *sold* to working men ; since then, others have been sold. M. Müller had sent to the Exhibition a work on the construction of houses for the labouring classes in town and country, accompanied by an atlas : this work is the best for any one wishing to appreciate what has been done in France. M. Bleck exhibited a model in relief of the 'Cité Ouvrière de Mulhouse,' made of pasteboard, to the scale of one centimètre to one mètré. Holland, Denmark, Switzerland, even Italy, had also contributed their share to the Exhibition of Domestic Economy; and M. Canevari, a Roman engineer, had sent a plan of houses adapted to the inhabitants of Rome and Central Italy.

"Messrs. Ducpetiaux and Dumont have exhibited a series of plans of houses for working men, both in town and country, as well as a specimen of a house furnished in every respect, which has given satisfaction. To economise space without too much restriction, systematize the means of *aeration* (*not ventilation*), to economize fuel without stint, are here the leading principles. In fact, sufficient studies and plans *exist*, but it remains to make them applicable, not to hundreds and thousands, but to millions of working people. The baths, washhouses, and lavatories, after the plans of Messrs. Wynaud, Janssens, and Reinaud, exhibited, are the best existing in Belgium. Amongst the materials for construction were the cements of Medina; the varnished tiles of the manufactory of Messrs. Jonas and Delanzie, of Antwerp; the materials employed by M. Müller, in the Cité Ouvrière of Mulhouse ; the specimens of Florentina marble from the quarries of Felny (Hainaut); and amongst them a chimney-piece ready for being fixed, at the price of ten francs. The Société de la Vieille Montagne had also contributed towards the Exhibition of Domestic Economy specimens of zinc, worked in all forms and for all wants, showing the great extent to which this metal can be used for building and domestic purposes. Messrs. Staadt and Deldine-Haut exhibited locks and other specimens of this sort, the prices of which are exceedingly low. The painted papers of Messrs. Vandelaer, Lorsont, and Leghers, at 25 cents. (2½d.) the *roll*, were much praised for their good make and pattern. The double-action pumps of Messrs. Mathilm, Brothers, which can raise 1,000 *litres* per hour, cost, with a *balancier*, only thirty francs."

On the whole, M. Ducpetiaux and the eminent men who assisted him in this great undertaking have every reason to be satisfied with the success of their exertions, and with the manner in which these have been appreciated by the members of the International Congress, and by the visitors in general.

It may have been remarked that some of the articles were above the sphere of the wants and means of the working-classes, and that others did not couple with their low price those qualities which would render them really cheap. But it must be remembered, firstly, that the scheme of economic collections, which was not made publicly known till last year,* cannot yet have assumed a clear and definite form in the minds of manufacturers. Secondly, the Exhibition Committee were naturally induced to accept many undesirable articles out of courtesy to exhibitors who had forwarded them from a distance. Thirdly, it was quite impossible to organize for a temporary exhibition the means of investigating physically or chemically the merits of the respective contributions.

All these drawbacks, which are inherent to a temporary exhibition, will disappear in the permanent Museum, which I am happy to say my Brussels friends fully intend to establish, having obtained for that purpose a considerable portion of the articles displayed, secured provisional premises, and been assured of the most favourable feeling on the part of the authorities.

As I have ordered a considerable number of copies of the Exhibition Catalogue, I shall be able to deposit several for distribution at the offices of the Societies of which I was a delegate at Brussels, viz., the Society of Arts, the Labourers' Friend Society, Exeter Hall, and the Metropolitan Association, 19, Coleman-street, City.

Allow me to apologise for this imperfect sketch, which circumstances have obliged me to make rather hurriedly.

T. TWINING, Jun.

Perryn House, Twickenham, Oct. 20, 1856.

SNAKES AND SNAKE BITES.

By P. L. Simmonds.

There is perhaps no casualty more common, and one more speedily fatal in the East and West Indies, Australia, the Cape, and other British Colonies and foreign countries, than that resulting from snake bites. To this accident travellers, settlers, and emigrants, are particularly liable. It is, therefore, of importance that every one should know something as to the venomous snakes, and what can be done by himself or others, at once, in such cases. As either suitable surgical instruments to remove the bitten part safely, or medicines (whose efficacy to prevent death, from such injuries, is also very doubtful) are rarely at hand, it is well that persons should be aware that they can scarcely ever be without means to try effectual measures. Bringing first into a focus the scattered information respecting the venomous snakes in different countries, I may follow it up with some remarks as to the remedial measures to be pursued, and shall treat upon the various plants and specifics whose virtues have been extolled.

I am but a simple gatherer of facts and opinions, and shall not presume to go into any theories, or to give undue prominence to any alleged virtues of professed antidotes.

The Commissioner at Scinde recently offered a reward of £50 for the best treatise on the various kinds of poisonous snakes in Scinde, the mode in which the poison of each operates, and the best method of treatment, showing the symptoms during life, and the *post mortem* appearances, together with a separate code of practical instructions for treatment and cure.

Snakes appear to be in Scinde what tigers are in Singapore, the second great cause of mortality.

"There is" (remarks Dr. Buist, in the *Bombay Times*) "something very singular in the extent of the snake nuisance in Scinde, by which three hundred lives appear to have been lost in the course of the year. This, taken in conjunction with the slaughter occasioned by the wolves in the Punjab, amounting to somewhere about twice as much again, and the destruction in a few months, of thirteen men by tigers at Singapore, impresses the mind more forcibly with the fact of the existence of a scanty and helpless population than a folio of statistical tables. Here we have man still battling with the beasts for the possession of the earth—the wolf feeding his cubs and provisioning his den from the cottage cradle—the husbandman laid dead, as he goes forth to cultivate his fields, by the bite of a reptile scarcely thicker than his finger or longer than his arm. At the battle of Meeanee we had 62 killed and 200 wounded; at Dubba our casualities amounted to 370 killed and wounded, 40 of these having fallen. The snakes commit more slaughter in a year than was incurred by us altogether in two of the hardest fought battles that had occurred in India in a century, and which "added a province fertile as Egypt to our dominion."

That these things must have gone on in the Ameers' reign for unlimited periods unnoticed may be taken for granted. Now that they have become known to us, no time should be lost or efforts spared to mitigate a mischief obviously capable of extinction. There are about forty varieties of very beautiful snakes in the island of Bombay, of which some four or five only are dangerous. The water snakes there are also venomous. The natives represent all snakes as poisonous, and as they are not very nice discerners of the fact, the belief, if not a sound, is a safe one, and may help to keep them out of harm's way. Few things would be more interesting than good collodion photographs of poisonous snakes. In Scinde, where gypsum abounds, and where the natives themselves are familiar with the art of plaster casting, fac-similies of the heads and necks of all the snakes in the country might be supplied to those authorized to pay the snake catchers. The mould once made, casts could be obtained in hundreds with the utmost facility.

A large and interesting collection of the snakes of Western India, preserved, has just been made by Mr. Sylvester, which is to be placed upon the shelves of the Grant College Museum.

An Indian writer, dating from Midnapore, in Bengal, observes:—"There are many local circumstances in this district which render the propagation of snakes and its attendant mischiefs a matter of easy occurrence. The vicinity of large tracts of uninhabited jungle, where every variety of the reptile acquires an uncommonly large size, and where the smaller ones being preyed upon by the larger, contribute in no small degree to render the latter by far the most predominant class; the nature of the soil; but above all, the antipathy and dread of the natives to destroy snakes of the cobra family, upon moral and religious grounds, may be said to be the principal ones. No Hindoo in this part of the country will kill a cobra on any account, because it is believed to have been a Brahmin in its former existence; and its death brings down upon the head of its destroyer the same amount of curse as upon him who kills a Brahmin. And they firmly believe that none but those who are predestined by the curse of a Brahmin will ever be bitten by that snake; hence the strange fatality on the part of the people, who will seldom hesitate to sleep in the same room in which even its hissings are distinctly heard; with so much infatuation on their part, it is rather surprising that comparatively so few casualties take place. I have very often seen the snake-catchers succeed in capturing large cobras, and after extracting their fangs, and playing with them for a few days in the streets, take them to the jungles of Gope, and leave them there to roam at large, or perhaps to find their way back into the city, through the Cassie. It is worthy of remark, also, that the station and town of Midnapore, owing to the numerous mud hamars (barns) which they contain, afford not only a safe retreat to these "little instruments of mighty mischief," but the mice holes which always abound in these rice houses attract and invite the snakes, on account of the very mice being to them a delicate food.

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* The "Mémoire" on this subject, which was so favourably received by the Emperor of the French in June, 1854, was only printed for private distribution.

That highly interesting and poisonous snake the Cobra, has received various names in different countries especially in India. It is the "Vepra Naja" of the naturalists, called by the Portuguese cobra-di-capello, and has the English names of the "Hooded snake" and the spectacle snake. Its Indian names are "Kuret," "Khorish," "Kellay," "Gowhun" and "Gokhoora," the latter derived from the semilunar marks on its head resembling the hoof of a cow. It is also called "Keotay."

Venomous serpents in general, and cobras (Najas) in particular, appear to be more prevalent in Hindustan in dry, rocky, or uneven ground, than in moist, level places. But further to the east, the cobra occurs as frequently in the moist plains of the Malayan peninsula, Penang, and Singapore, as in the hills.

The ophidia of Ceylon are numerous, and the Singhalese state that there are about sixteen venomous species.

Mr. Sylvester has illustrated the direction of the poison apparatus of the "Vipera Russelli," consisting of a gland for the secretion of the poison, a duct, and a poison tooth, or fang.

"The *gland*" is oval, of a pale fawn colour, about the size and shape of a small almond, and consists of a number of elongated lobes; each lobe is divided into smaller ones, or lobules, in which the poison is elaborated. The gland is enveloped in a tolerably firm capsule of fibrous tissue, which is attached to the cranial bones by processes, and being in contact with the surrounding muscles, the expulsion of the poison is greatly facilitated.

"The *duct*" conveys the poison from the gland to the fang. It commences as a groove near the base, and in front; then becomes deeply lodged in the centre of the tooth, where it is protected by two inflections of enamel, which unite and convert the groove into a canal, again to become a simple groove at the apex of the fang, to permit of the discharge of the poison.

"The *fang*" in this instance is about ¾ of an inch in length, presents a sabre-like curve, with the convexity anteriorly, the base is laterally compressed, and the apex is produced to the finest point. In both jaws a reserve fang is embedded beneath that in use.

Mr. Sylvester also points out that harmless can readily be distinguished from venomous snakes by an examination of their teeth. The poisonous kinds are deficient of an outer or marginal row of teeth in the upper jaw, which are present in the harmless varieties, and are fixed to the maxillary and premandibular bones, but their place is supplied by the grooved poison-fang. Both varieties have two palatal rows of teeth, which run from before backwards, a little outside the median line of the roof of the mouth, and are embedded in the palatal and pterygoid bones.

A few exceptions however occur, as in the genera "Dryophis" "Dipsus" and the "Bucephalus," where the marginal teeth increase in size backwards, and several of them are traversed with a groove through which an acrid saliva is injected; but no true poison gland exists.

In making an examination of poisonous snakes some little care is necessary, as they have the power of concealing the poison fang in the lax gum, by a rotation backwards of the superior maxillary bone, and thus they effect a change in the direction of this large tooth, which would otherwise impede the passage of the food through the mouth.

I may quote from a paper recently read at the Literary, Scientific, and Medical Society of Graham's Town, a few additional observations on the structure and functions of some parts of the serpent:—

"The poison apparatus consists of two parts—a gland for the secretion, and a fang for the transmission of the poison. The glands are two in number, and occupy the sides of the posterior half of the head. Each consists of a number of elongated narrow lobes, extending from the main duct which runs along the lower border of the gland upwards and slightly backwards. Each lobe gives off lobules throughout its extent, and each lobule is subdivided into smaller secorning cœca, which constitute the ultimate structure of the gland. The whole gland is surrounded by a double aponeurosic capsule; the outermost and strongest layer is in connection with the temporal bone.

The poison fangs are situated on each side of the roof of the mouth, and are firmly united to the upper maxillary bone. Behind these fangs there are the germs of several undeveloped fangs, ready to take the place of those which are in use if they should be broken. These supplementary poison fangs are loosely attached by ligament to the bone, and are covered over by a firm membrane. Professor Owen remarks "that a true idea of the structure of the poison fang may be formed by supposing the crown of a simple tooth to be pressed flat, and its edges to be then bent towards each other and soldered together, so as to form a hollow cylinder, open at both ends. The flattening of the fang and its inflection around the poison duct commence immediately above the base, and the suture of the inflected margins runs along the anterior and convex side of the recurved fang; the poison canal is thus in front of the pulp cavity." In this way the fang appears, as is commonly described, to be perforated by the duct of the poison gland. The fang—which the writer now produced—with a bristle passed through the poison canal, illustrates very plainly the poison canal passing along the convex side of the tooth, with the pulp cavity of the tooth behind it. It also shows the termination of the canal a little above the point of the tooth, a construction which renders this part much stronger; and, consequently, less liable to be broken when the deadly blow is struck, than it would be if the canal had been carried on to the extreme point. The poison fang rotates with the superior maxillary bone, so as to keep the tooth laid flat at ordinary times, and to erect it when the animal wishes to use it. During this act the head of the snake is raised, drawn backwards, the fangs erect—and exposed by the widely opened mouth—are struck, by the force of the powerful muscles of the head and neck, into the surface aimed at:—the poison bags at the same moment are squeezed, and their contents driven, through the canal in the tooth, into the wound. Professor Owen thinks that the rage which stimulates the venom snake to use its deadly weapon, excites increased secretion of the poison, just as the salivary glands secrete more saliva when excited by certain emotions—as, for example, the sight of food frequently—to use a common expression—"makes the mouth water." A very interesting and accurate account of the arrangement and structure of the poison-fangs in a rattle-snake, dissected in the year 1682, by Ed. Tyson, M.D., is given in the *Philosophical Transactions* for that period.

The teeth of the serpent are small, simple, conical, and directed backwards. In the non-venomous species there are four rows in the upper jaw—two outer, attached to the maxillary and inter-maxillary bones; and two inner, attached to the palatine and pteryoid bones. In the venomous kinds the outer rows of teeth are supplanted by the poison fangs. In both the venomous and non-venomous species, the lower jaw is armed with a row of sharp, recurved, simple teeth. In some serpents, the inferior spinous processes of the cervical vertebræ are long and sharp, and penetrate the upper wall of the gullet, and serve for crushing food, such as eggs, &c., upon which these animals feed.

In treating of the distinguishing characters between the poisonous and the harmless serpents, the writer observes that the differences may be arranged under two heads: first the existence of poison fangs,—second, external characters.

The structure and appearance of the poison fangs have been already described; but it appears that some authorities doubt that all serpents destitute of pierced fangs in the lower part of the jaw are non-venomous. In the last edition of *Cuvier's Animal Kingdom* it is stated that all have a maxillary gland, often very large, and the back teeth frequently exhibit a groove which would seem to contain some liquor. This much is certain, that various species—the back teeth of which are very large—are reputed to be extremely venomous in the countries which they inhabit,—an opinion which is confirmed by the experiments of Lalande and Leschenauld, which it is desirable should be repeated. Again, it is not always an easy matter to distinguish between the poison fangs and the common teeth, for in some varieties of serpents there is scarcely any difference in the size and appearance of these structures. As a general rule, however, when there is found a tooth-like process firmly united to the anterior and external part of the upper jaw-bone, the latter bone at the same time being very small and moveable, then there is considerable certainty of the existence of a poison fang. The following simple operation will assist in distinguishing between the poison fangs and common teeth. Let a pin be drawn from the anterior and external part of the upper jaw to the angle of the mouth; if no more teeth are felt in that line than one or two at the fore part, it may be certainly concluded that these teeth are fangs, and that the serpent is a venomous one. If, on the contrary, the teeth before mentioned are found not to stand alone, but to be only part of a complete row, then it may as certainly be concluded that the serpent is not venomous.

Next, as to external characters which assist considerably in distinguishing poisonous from harmless serpents. As a general rule venomous serpents are found to have a broad, flat, and depressed head. There are a few exceptions to this rule, as, for instance, the naja, a species well known to be venomous, which has a head neither broad nor depressed; and again, the genus boa, which is not venomous, has a broad and depressed head.

In the venomous species the tail never exceeds one-fifth of the length of the body. It may be much shorter, but in no specimens which have been examined has it been found any longer. It appears that little dependence can be placed upon this circumstance, as a tail as short is sometimes found on the non-venomous species; nevertheless, it is pretty certain that a snake with a tail exceeding one-fifth of the length of the body belongs to the harmless kind. The form and appearance of the tail may also be taken, to some extent, as an indication of the venomous or non-venomous character of a serpent. A thin and acute tail is by no means always found on the poisonous, but a *thick* and *obtuse* one is *only found* in the harmless species.

The elevated line, or carina, seen on the scales of many serpents, is a mark of great use in distinguishing the species. Of 112 varieties of serpents not venomous examined, 80 were found to have smooth scales, and 32 to have carinated scales. Of 26 venomous serpents examined, 20 had carinated scales, and only 6 had smooth scales. So that in the venomous species carinated scales were ascertained to exist in the proportion of about 4 to 1, whereas in harmless serpents the proportion was about 1 to 3.

Although, then, any one of the signs just enumerated cannot be considered as indicative of a venomous or non-venomous serpent, yet, where they are found to exist together, its character may with perfect certainty be decided upon.

Among the venomous snakes of the Cape Colony are the cobra de capella, the puff adder, the berg or mountain adder, the boom slang or tree snake, and the garter snake. There are others which are believed by some people to possess noxious qualities—a belief, however, not warranted by dissection.

Of the cobra de capella there are two varieties, one named the true cobra, which is of a bright yellow colour—the other, of a dark olive hue, is termed the bastard cobra. These are both equally venomous, and possess the power of erecting themselves and swelling their hood, which does not bear the mark, in form, of a pair of spectacles, which is found on the cobra of Ceylon and India when attacked or irritated.

When full grown, they are from 4½ to 5 feet in length; the yellow species having rather the advantage in point of size—the head flat and somewhat triangular, but the tail long and tapering. The upper jaw is arched, with one, sometimes two fangs on either side, through which the poison is ejected from the reservoir when the reptile fastens on its enemy or prey. This reptile has been so audacious as to pursue a man for a considerable distance, and it has been said that individuals have been obliged to run from them—a statement which requires confirmation, for though, when attacked, the creature assumes an attitude of defence, yet, if an opportunity offer, it glides away to a place of concealment.

The puff adder has a broad flat triangular head, and a short tail, tapering very abruptly—the characteristic marks of a poisonous reptile. It is about 2½ feet in length, of a disproportionate length, the skin being beautifully marked with various hues of black and bright yellow. The mouth is wide and capacious, with two long curved fangs on either side of the upper jaw. When irritated, it utters a remarkably loud hiss, resembling the steam from a tea-kettle. It has been affirmed that this reptile possesses the power of throwing itself backwards to the distance of several feet when it strikes its prey, which it is said to do with unerring certainty. This perhaps is somewhat fabulous, as the animal appears to be rather torpid and inactive.

The berg or mountain adder, as its name indicates, is generally found on the summits or sides of mountains. It is said to be the most venomous snake which inhabits the Cape colony. It is small, not exceeding a foot in length, and of a grey colour; the head is flat and triangular, and there is a peculiar crest or ridge over each eye; the tail is short and abrupt; the upper jaw is armed with fangs. From the colour and size of this reptile, it is particularly dangerous, owing to the liability of its being trodden upon unobserved.

The boom or tree snake, although it possesses fangs, is deficient in marks of being a venomous reptile. It measures about five feet in length, the circumference of the body being small and tapering, which peculiarly adapts it to the habits of the animal in gliding from tree to tree, which it does with incredible celerity. Its colour is dark brown or olive, the plates along the belly being of a bright yellow hue.

In Natal serpents are abundant, and many of them are very poisonous, though they are not usually aggressive in their disposition. The puff adder, the cobra, the pystur, and a large green snake, held sacred by the natives, are the most frequent and the largest. One serpent is capable of projecting from its mouth two fine streams of a poisonous fluid, which causes severe inflammation of the skin with which it comes into contact. Scorpions are often met with, the sting of which, though exceedingly painful, is not often fatal.

The bite of different sorts of serpents in Southern Africa is generally fatal very soon after the infliction of the wound, and many instances of losses of life annually occur from this cause, especially in the more grassy districts bordering on the coast, both eastern and western.

Mr. Chas. L. Zeyher, in a recent botanical journey into the interior of Southern Africa, remarks that one of his dogs "started into a dense bush when we came near to him, bringing out in his mouth a snake, of the kind they call 'Spugg slang,' or 'Spit snake.' They are considered very poisonous, and the poor dog, being wounded in the struggle with the venomous reptile, showed dangerous symptoms soon afterwards. He began to stagger along the path which we travelled, and lost his sight. It was fortunate that we had fresh milk at hand, of which we gave him repeatedly to drink, with which valuable medicine we arrested the progress of the poison, and the dog was finally, though slowly cured. These kind of snakes are not rare in the western districts of the Cape Colony, towards Namaqualand. They can force, through the hollow of their fang, when they are pursued hotly (as they instantly turn when they cannot escape, facing their combatant), a very caustic acid, smelling like formic acid, and spirt exactly into the face of their enemy. One instance I can relate where I pursued such a snake near the banks of the Kousie River. Having no chance of escape, it turned round, and, facing me, projected a frothy liquid towards me, of which only a small quantity touched the under part of my face, but the most of it fell on my breast. It was fortunate that the distance between me and the snake was about eight paces, otherwise the poison would infallibly have reached my eyes, and blinded me. Thinking it was an Elak-snake when I pursued it, I had no idea of any danger at such a distance, until I received warning of that dangerous reptile. We despatched it, however, but it cost one of our whip-stakes, which the waggon-driver broke when beating it. These kind of snakes seem to be equally dangerous when they bite with their teeth, as when they spirt through the hollow of their fang a poisonous fluid into the eyes of their pursuant."

Snakes are numerous in various parts of Australia. A good account of those common in New South Wales was given in the 13th vol. of my *Colonial Magazine*. They include the following:—

1. The black snake. This, which appears to be a species of the genus *Acanthophis*, is numerous; the bite is not considered fatal, or, rather, is the least deadly of all the kinds. Their usual length is from three to eight feet. The natives cure themselves when bitten by sucking the wound and bathing it with water. The snakes delight to frequent river banks, creeks, and moist places. 2. The yellow snake, usually larger than the black, varying commonly from four to ten feet; the bite is generally fatal. This species is said to creep abroad by moonlight in the summer season. 3. The greyish-coloured snakes are very venomous, and may be often found in the neighbourhood of houses and farms. in search of mice, eggs, and birds. One lately entered into a cottage, and meeting a cat bit it; the animal jumped, and fell dead instantly. In October and November the poison seems to be more active than at any other season of the twelve months in all the class. 4. The brown snake is greatly dreaded by the aborigines; the bite is suddenly fatal; they frequent moist situations, mountain bottoms, &c., and are smaller than most others yet described, varying from two to six feet in length. All the serpent tribe seem to require water for drink once a day in summer. 5. The carpet or diamond snake grows to a large size; some have been seen eight, twelve, sixteen, and, credible witnesses say, twenty feet long. The poison is not so virulent as many others, which may be inferred from their large size; they habitate the mountains and rocks, and have frequently been killed with large opossums in their bellies. Hollow logs are a frequent resort for all the serpent tribe, and during the day a fallen tree is always a seat of danger to the bushman. 6. The green snake is usually found in scrubby grounds or thickly-wooded places; the bite is very deadly, and suddenly fatal; they may often be seen lying on branches of trees, ready to drop on the passenger, bird, or other prey; they are expert climbers of trees, slender, and rarely more than five feet in length. On the Clarence River these snakes are very numerous, and are often seen pendant from the forest trees. 7. The whip snake is usually of a light gray colour, from two to three feet long; they frequent the banks of rivers and creeks, and nestle in the earth or in the hollows of trees. A variety is found at Port Boyne of much brighter colours and larger size, frequenting trees in great numbers. All the whip snakes are proverbially dangerous, and the poison most active and fatal. The whip and green snakes are said to be more dangerous than any other, for they not only stand on the defensive, but will attack, without provocation, the unwary traveller. 8. The water or ring snake is usually found in wells, water-holes, or stagnant pools; they often exceed five feet in length; the number of rings increase with age. One of six feet (rare), when killed, had thirty-three rings, and no two rings alike in colour. It is the most beautiful of the tribe, if such "varmint" can be called so. The writer is not aware whether their bite is dangerous, but he would avoid making the experiment. 9. Though not pertaining to the snake tribe, the deaf adder may be mentioned, of a different shape and habits. Its poison is not less fatal than any of the serpent race. The eye of this hideous reptile is vivid yellow, with a black longitudinal pupil. The colour of the body is difficult to be described, being a complication of dull colours, with narrow blackish bands, shaded off into the colours which compose the back. A coarse lumpy head, body commonly eight to twelve inches long, sometimes two feet, tail terminating suddenly from a lumpy body to a point, in which tail or extremity, according to popular rumour, is a needle-like sting, holding a poison so active that, injected into the blood, death ensues, without remedy, to large animals in twenty or thirty minutes, and to small ones instantly. They are usually found about old rotten wood and bark of dead trees, are very sluggish and inactive, and never sting but by mischance. Some men say the reptile possesses the power of contracting the body, and elongating the same to eighteen inches or two feet. 10. The slow-worms are from three to twelve inches long, and a dirty brown colour. They are found in soft sands or hills of loose earth, but are as totally blind as the adder is said to be deaf. Their poison is as fatal as that of the deaf adders.

The collection of serpents deposited in the Museum of Natural History at Paris, by different naturalists and travellers, comprises about 380 species; one-fifth of this number is found to be composed of the venomous kind, in so far as can be ascertained from the habits and peculiar fangs of the serpents. Amongst the varieties of the venomous serpent, the first in rank is the rattle snake, found throughout the continent of America, and whose sting proves mortal in less than six minutes. Next comes the Naja or spectacled serpent, which exists in the east, and thirdly the spear-headed serpent (Trigonocephalus), of Martinique and St. Lucia. The venom of the viper is less virulent than that of many of the poisonous serpents, but still sufficiently severe in the warmer climates to produce even the most fatal results.

In the island of Trinidad, there are few kinds of poisonous snakes. One about two feet in length and very beautiful, is called the coral snake. The second, about 3 feet long, is termed the cascabelle. The third, called the mapapero, reaches the size of five or six feet, and is bold enough to attack a man. The last, known as the pine-apple snake, is very rare. It attains the size of 7 feet long, and is as thick as a man's leg in circumference. It is of a bright yellow colour, spotted with brown, has about 207 plates on the body and 82 on the tail; the scales are in the form of lozenges, like the rind of a pine-apple, hence the name; boa constrictors of an enormous size, are occasionally met with in this island. In 1818 one was killed that measured 18 feet; subquently, one was taken in the mountains above Port of Spain, the capital, considerably larger. When opened, a deer was found in his maw. The stings of two kinds of scorpions, a brown and a black variety, are severe but not mortal.

Snakes are numerous in Canada; but venomous kinds are not so plentiful as in the country more south (in the United States). The venomous kinds embrace the rattlesnake, adder, and the copper-head.

Those which are harmless consist of the large black snake, the small brown snake, and the garter snake. Great numbers of the snakes are destroyed by the large hawks, which seem to consider them a very delicious morsel.

In the United States the bull snake averages from five to nine feet in length. It is prettily marked on the back,* of a wood colour and dark brown, mingled in squares; the belly is yellowish. This snake has a very tough hide, which it is impossible to break with a club. It is a formidable foe to poultry—but its bite is not reckoned poisonous.

The common striped snakes are plentiful, and the rattlesnakes are often met with in the forests.

The little striped lizard and the large black and yellow spotted lizard are reported to be venomous.

Having occupied so much space with a description of the varieties of poisonous snakes common in different localities, I must defer the remarks and observations upon medical measures and the antidotes recommended until another opportunity.

8, Winchester-street, Pimlico, Oct. 15, 1856.

Colonial Correspondence.

THE RESOURCES OF JAMAICA.

Sir,—Will you be good enough to publish the accompanying interesting information, kindly furnished by Sir Wm. Hooker, with full permission to make such use of it as I may think expedient.

Yours, &c.,
LEONARD ROWE VALPY,
Agent of the Royal Society of Arts of Jamaica.
5, Spring-gardens.

"For a long time "Cuba bast" was the product of a plant not known to botanists, and supposed to be *peculiar* to Cuba. It used to be employed for tying up bundles of cigars at Havannah; and, of late years, it has been extensively employed for tying up plants, and sold at all seed-shops and at horticultural establishments.

"During the past twelve months, I have twice or thrice received from Cuba seeds of the bast plant, and satisfactorily proved it to be the inner bark of the *Hibiscus elatus*.

"I have just received from Wilson (the curator of the Botanical Garden, Jamaica) the *same material identically*, the 'Mahoe' of Jamaica, and quite correctly named '*Hibiscus elatus*.' *Cuba bast may thus be had in any quantity in Jamaica.*

"Don Ramon de Sagra, in his 'Flora of Cuba,' fully describes the *Hibiscus elatus*, and never suspects it produces the Cuba bast. Wilson obtains the same substance from *Hibiscus elatus* as the Cuba bast, without suspecting it to be such."

Home Correspondence.

BESSEMER IRON.

Sir,—I examined with pleasure the samples of tinned plate and Tagger iron which you had received from South Wales, and which were said to have been rolled out of iron made by Mr. Bessemer's process. There can be no doubt but that if iron, such as I saw, can be *uniformly* made to produce such results as these exhibit, and with no loss in yield beyond that which attends the customary methods, much value may attach to it; but unless we trace every detail, and know its cost, there is nothing surprising in it, since, without any puddling operation, from the ordinary refinery, charcoal malleable iron has been made with all the purity that is seen in these samples.

Even these, therefore, prove nothing as to the commercial value of this process; and unless something very much beyond merely showing samples, or making an occasional bar, is done by some well-known ironmaster, at whose mills may be seen some hundreds of tons of iron made per week by this method, there will be very little credence given to its merits by practical men.

If it really is so satisfactory, and the product of the Bessemer furnace is a pure malleable ingot, ready for the mill without undergoing the forge process, what is there to prevent Mr. Bessemer, or any licensed ironmaker, from rolling off the finished iron at once. The apparatus is not expensive, nor are there wanting at any iron-works the materials with which to construct it, so as to be at work in a week, and yet weeks and months are passing over, and all we hear of is a sample piece of sheet iron, or a bar or two, made thereby. No, the fact is, there are found to be practical and serious difficulties in the way, which Mr. Bessemer has not been able to overcome, and which, he will find, cannot be put aside, so as to make it economical, and thereby establish its commercial value.

Two things have been promised to the public: to make pure malleable iron *without additional fuel* in the conversion from cast iron; and, by thus saving all the forge process, realising an economy of *forty shillings per ton.* Not only a saving of forty shillings per ton, but securing a quality of iron equal to charcoal iron by all impurities having been abstracted. Two results would follow upon the promise being realised, namely, a saving of not less than *three millions of pounds sterling per annum*, upon the quantity of malleable iron now made, and the satisfaction of having *a good article* for all the common purposes of life wherein iron may be applied. If realised, the introducer ought to be placed on the highest pedestal of public regard; but, if promised, and not realised, where should he then be placed?

I mean no ill-will in asking such a question, but I confess that I must put both sides of the picture, since no proposal such as that given could be advanced without disturbing much of the business of ironmaking; and the non-realisation of large practical results tends rather to place Mr. Bessemer under the second head of the question.

However, as Mr. Bessemer has two patents still unspecified, although, I confess, I do not see, from anything he has yet done, any opening which will secure the results he contemplates, as he has really done nothing beyond that which Mr. Martien had reached before him, I should be glad to see proofs of intrinsic merits by the iron trade grasping at the saving promised, which they would do if they were only sure of a satisfactory and substantial result, but which can only be hoped for *from something still unspecified.*

I am, &c.,
THOS. W. GLADSTONE.
10, Austin-friars, 18th October, 1856.

ADULTERATION.

Sir,—This subject is now occupying much attention, and it is desirable that some practical regulations should be adopted with as little delay as possible. The principles of liberty must not be permitted to give sanction to so dangerous a system of fraud, or to protect the few, at the risk of health, and even life, to the many.

The concentration of individual opinion will in this, as in most other questions of public interest, afford the surest guide to those who have to frame the required enactment. Possibly, the following contribution to the general stock of suggestions may be deemed worthy of consideration.

A broad distinction must be made between unwholesome adulteration and simple adulteration, as the latter, though fraudulent, may yet be wholesome. Among the former may be instanced the poisonous preparation of sweetmeats; and of the latter class, is the Irish salt butter, washed and sold as fine Epping butter.

The author of a valuable work, entitled "The Tricks of Trade in the Adulteration of Food and Physic," recommends the system of government inspection as the only available remedy; but there would be danger of a counter-balancing evil in the tendency of the people in such cases to rely solely on the protection of the government.

It may be that a middle course could be adopted, by enacting that on the sale of all articles, in value over a low fixed figure, the purchaser might require a statement from the vendor of the contents, which could easily be given by means of a printed label. Any party giving a false statement should be liable to a fixed penalty, or term of imprisonment.

To protect the poorer classes it would be necessary to appoint inspectors, with power (limited within due bounds) to demand samples, which should be sealed in duplicate—one of which should be left with the dealer, and the inspector should deliver the other to a recognised authority for analysis, and in case the charge of adulteration was to be made, the inspector should be authorised to demand the second for a similar test, to be made in the presence of the dealer or his representative if required. The punishment imposed might be made to vary according to the per centage of adulteration.

The occasional visits of such inspectors would not be more objectionable or irritating than those of the inspectors of weights and measures. It must always be remembered that such hindrances to fraud operate directly to the advantage of the honest trader, and surely the aggregate of society need not have much compunction respecting any reasonable interference with the tricks of the trade.

Some such system might be tried in London, where offices for analysing could easily be established. If the main source were purified there would be a speedy reaction in the country, and in case country dealers persisted in the present nefarious practices, there would be an available remedy by means of existing—and daily extending—facilities of communication with the metropolis.

I have only ventured to trouble you with a cursory outline of the views which have occurred to me, but by ventilation in your columns, any portion that may be of practical utility is pretty sure to be recognised.

I am, &c.,

L. R. V.

AMPHIBIOUS CARRIAGES.

SIR,—One of the authorities who witnessed officially Mr. Francis's experiments at Woolwich, assures me that he (Mr. Francis) disclaims all other inventions than that of the corrugation of metal for boats, &c., and the apparatus for effecting this purpose. Thus, what has been said of the advantage of amphibious carriages in warfare, remains wholly attributable to Brigadier General Sir Samuel Bentham. I ought to have added to my communication of the 19th ultimo that in the summer of 1830 Sir Samuel met with an accident, which eventually proved fatal, and which prevented his further prosecution of the subject in question with the Duke of Wellington.

Mr. Francis corrugates the metal by hydraulic pressure, but it was observed by my friend, that of course a rough surface retards the speed of a vessel, and this might be a serious obstacle unless remedied.

I am, &c.

M. S. BENTHAM.

26, Wilton-place, October 27th, 1856.

INUNDATIONS.

SIR,—The awful destruction of life and property by these constantly recurring almost annual disasters is a matter for serious consideration, the more so, because it is to our own want of caution and foresight that we may mainly attribute these distressing events.

Rivers and brooks are the natural drains of the country, and if we obstruct their course by dams and weirs we contravene nature's laws, and must abide the consequences.

Every dam or weir raises the bed of a river with regard to the surrounding country, prevents the freshes or floods from scouring away the summer deposits, greatly increases the height and extent of every inundation, and renders almost insurmountable the difficulty of getting rid of our waste waters and sewage. For if our rivers and all their tributaries could by any means be freed, from the source to the sea, of every artificial and other obstruction, draining, for either surplus water or sewage, would be easily and effectually accomplished with neither extraordinary trouble nor great expense.

Thus if the Thames, from its source in Gloucestershire, and all its tributaries, were cleared out, and the most exaggerated serpentine bends eased or removed, the citizens of the metropolis would meet with very little difficulty or expense in getting rid of waste water or sewage. The bed of the river would be much lower than it is at present, and the ebb far more powerful, more so indeed, than the flood.

Brindley, the great progenitor of inland navigation, after he had been running down rivers as useless incumbrances, when he was asked by the Members of the Committee of the House of Commons what he thought they were made for, he, after some hesitation, made this memorable reply, "*That they must have been created in order to feed navigable canals*," entirely forgetting the true purpose and intent of rivers and brooks, and that he was entailing upon posterity the curse of increased inundations, as well as the almost overpowering difficulty of getting rid of our drainage.

Brindley, though a great and skilful engineer, was, however, an unlettered man, and was in the habit of devoting days and nights continually in bed to making his calculations by head-work alone.

We are not satisfied with creating or allowing all this mischief; but we are so perverse and headstrong, that we take delight in building and setting up our farms and buildings, our warehouses and factories so close to the water's edge, as to be actually, in many cases, below ordinary high-water mark, and dreadful is the result when a tide or flood rises above its customary standard, which is often the case early in spring and late in autumn.

There is yet another evil of no small magnitude, resulting from our artificial and other obstructions to the course of our rivers and their tributaries. There are many harbours, I should rather say there were (for many have long ceased to be), which those obstructions have caused to silt up and become useless, or so filled them with shoals and flats as to render the navigation intricate, difficult, aud dangerous.

I have constantly before my eyes in this and the adjoining counties, ample instances of the mischief I complain of. The town of Wareham, situated at the head of Pool harbour, has two rivers emptying themselves into the harbour, of which two rivers, the Frome and the Piddle, every inch of fall has been made available for some other purpose or other. What is the consequence? In the time of the Roman occupation of this country, Wareham was a seaport town, and the largest ships of that day could come close up, whereas now our common coasting vessels cannot approach the town within four miles. The remains of great Roman highways, commencing at Wareham, and running entirely across to the eastern coast, are still to be seen. The entire courses of those two rivers have been a succession of dead levels, the falls at the mill-dams having, of course, no effect whatever in scouring the bed of a river.

Christchurch harbour was once of some note, now scarcely navigable for small fishing boats. Christchurch has also two rivers, the Stour and the Avon, each reduced as usual to a series of dead levels by means of artificial obstructions. The same may be said of Lymington and Beaulieu, which are both in the same deplorable condition.

There is no need, however, to multiply examples. Take the whole coast line from the Thames' mouth to John o'Groats, and the same results, derived from the same causes, may everywhere be seen.

In bygone times, when population was thinly scattered, and industry and commerce were in their infancy, these effects were neither so frequent, so severe, nor so much felt as in these busy stirring times; but we have now a colossal power, as cheap as water power in most cases, and cheaper, when the destruction of property and loss of life is taken into account. The only drawback, and a great one, is the vast accumulation of vested rights and interests, the cost of the purchase of which, however, would in the end result in an immense saving to the country at large.

I am, &c.,
Poole, Dorset. HENRY W. REVELEY.

HYDRAULIC CEMENT.

Sir,—The want of a cement under this title is unknown to the Italians, their brown or water lime being the only substance used where hydraulic mortar may be required. It is a comman lime of the country, and is used indifferently for all foundations of public and other buildings, outside work, fortifications, and works under water, or exposed to the dash of the sea. The Italians have also the usual white lime, but it is only used for interior work. These two limes are both the same price to purchase, but the white is the cheapest, because it will carry half as much sand again as the brown will. The latter is made from the boulder stones washed down by the Apennine torrents, while the white lime is made from the regular limestone rock, and though wholly unfit for hydraulic mortar, a dab of whitewash will remain exposed to the weather on brick, tile, or stone, for centuries.

The brown lime mortar does not set rapidly as all our artificial cements do, but as the only precaution necessary in using this mortar is to inundate the courses with water as fast as they are laid, it forms a solid concrete mass when actually used under water, it matters not whether salt or fresh. As a proof of strength I may state that the Italians build their largest wine-vats of only four-inch work, often eighteen or twenty feet high, stuccoed inside and out with the same mortar, composed of brown lime and coarse strong sand. Iron hoops are slipped on outside, as a measure of precaution. In every case the Italian hydraulic mortar has endured for ages, as innumerable works on land and in the sea, of ancient and more recent times, most amply testify. It is true that in the more important works, "Pozzolana," or volcanic cinder of clay, is used in grains as large as pepper-corns, instead of the usual coarse sand: but that same "Pozzolana" would be utterly useless if mixed with the common white lime.

This short notice is intended to stimulate geologists to seek for a similar limestone in this country: it may possibly be found in Wales. The object to be gained is of some importance, as the discovery would entirely supersede the very expensive processes of manufacturing and grinding our various patent and other cements, which are all vastly inferior to the common water-lime of Italy that has been used from the most ancient times, ages prior to the foundation of Rome, until the present day.

I am, &c.,
Parkstone. HENRY W. REVELEY.

Proceedings of Institutions.

Bradford.—The fourth year of the Literary Institution having terminated, the Committee, in presenting the annual report of their proceedings, congratulate the members upon the steady progress of the Society, and the continued interest felt in its welfare. Great liberality has been shown by those members who have voluntarily come forward and increased their yearly subscriptions to enable the Committee to meet the extra annual expenditure. The number of subscribing members during the past year, ending August 31st, is 148; the total revenue from subscriptions amounts to £72 8s., of which £67 is from annual subscribers, and £5 8s. from half-yearly and quarterly subscribers. The lectures for the past year, though neither so numerous nor so well attended as could be desired, have been of high interest and ability. The library has received numerous additions during the past year; the number of volumes issued to the members has been 1,902. The "Mutual Improvement Class" meetings have been well attended; eighteen evenings have been employed in the reading and discussion of Essays on various branches of Literature and Science, interspersed with dramatic and poetical readings. The following gentlemen constitute the Committee for the ensuing year:—Mr. G. Spencer, Mr. Eml. Taylor, Mr. T. Scutt, Mr. G. Spackman, Mr. H. Summers, Mr. W. C. Green, Dr. W. Adye, Mr. W. Taylor, jun., Mr. J. Baines, Mr. H. King, Mr. G. Chapman, Mr. W. Hale.—*Treasurer*—Mr. J. Overbury; *Librarian*—Mr. S. Taylor; *Honorary Secretaries*—Mr. G. Marks and Mr. J. Bulgin. The Committee having made every exertion in their power to bring the Society to its present status, suggest that much may still be done by personal influence and individual exertion to procure additional support, and render permanent the interest which the public has shown in supporting this valuable Institution.

Chichester.—The anniversary meeting of the members of the Literary Society and Mechanics' Institute, took place on Wednesday evening, the 8th inst., in the lecture-room, South-street, on which occasion there was a tolerably numerous attendance. Dr. Tyacke having been unanimously called to the chair, the secretary, Mr. J. Gauntlett, read the report from the committee, in which it was stated that the Society at present occupies a more prosperous position than at any former period, the number of members now being 468, against 415, the number at the corresponding period of last year. The treasurer's balance-sheet exhibits a sum of £14 18s. 7d. in favour of the Institution. The members were next congratulated on now possessing the advantages (in addition to their museum, library, and a course of excellent lectures) of educational classes, and, with a view to afford additional accommodation for these classes, and at the same time provide for the better arrangement of the specimens and articles in the museum, extensive alterations and repairs had been recently effected. According to the report of the class committee, the average attendance of students at the arithmetic class was 46, at the French, 60, at the music, 50; those attending the German were less numerous, but equally zealous. No less than 1,428 persons visited the museum during the last year. A course of lectures has been arranged for the winter season, which, from their variety and the high character of the lecturers, promises attractions equal to any former session. The desire on the part of the committee to establish a reading-room has not at all diminished, but they regret that the Act of Parliament relating to the rating of Literary and Scientific Societies, according to the technical construction of the highest legal authorities, remains in a condition which renders it practically inoperative, except under very limited restrictions; in consequence of which they have hitherto been precluded from establishing a news-room in connection with this Society. An attempt, under the auspices of a committee appointed by the Society of Arts, was made to procure an amendment of this Act during the recent legislative session, but, notwithstanding the support received from members of all parties, the difficulties encountered in the arrangement of details, led to its postponement for the present; nevertheless, the committee entertain a confident hope that at no very distant period, by perseverance, in conjunction with other similar societies, the Act in question will be so modified as to enable future managers of this Institution to add to the advantages already so liberally afforded to its members. The donations to the museum and library have been numerous and valuable. On the appointment of officers to serve during the ensuing year, his Grace the Duke of Richmond was re-elected President; the Rev. J. Fullagar, Dr. Tyacke, B. Adames and W. Gruggen, Esqrs., Vice-Presidents; H. W. Freeland, Esq., Representative to the Society of Arts; Mr. G. Paull, Treasurer; Mr. T. Pescod, Curator of Apparatus; and Mr. J. Gauntlett, Secretary. The thanks of the meeting to this gentleman for the zeal and assiduity displayed by him in gratuitously discharging the duties of Secretary, were moved by Mr. B. Adames, and seconded by Mr. Molesworth, and carried in a manner testifying the warm approbation of the members. Thanks were voted to H. W. Freeland, Esq., for his conduct as representative to the Society of Arts; when, in the course of his reply, he remarked upon the difficulties in the way of effecting any amendment in the Legislative Act relating to the rating of Institutions, but observed that its decision rested with the constituencies of the kingdom, who, by the exercise of a little wholesome pressure upon their representatives in parliament, might obtain a speedy settlement of the question. Thanks were next given to the conductors of classes during the past year, to which the Rev. M. Parrington responded. The business closed with a vote of thanks to the chairman, which was carried by acclamation. The session of lectures commenced with one by Dr. Letheby, upon Chemical Magic, illustrated by numerous and brilliant experiments, and one by the Rev. Hugh Hutton, minister of the Borough-road chapel, on "The Art of giving Expression to Poetry." Classes are in course of formation for the study of Arithmetic and Algebra, English History, the French, German, and Latin languages, and for the practice of Singing and Music.

RICHMOND.—The Annual Report of the Parochial Library and Reading Room congratulates the members on the rapid growth and increasing prosperity of the Society. The Library has been very successful, both as to the number of books that have been added to it, and the use that has been made of them. Above 1,000 volumes have been added during the past year, and it now consists of 1,500 or 1,600 volumes. 2,000 volumes have been taken home by members to read, besides those perused in the room. With respect to classes, some progress has been made, and those already held have been a Bible Class, by the vicar, a French Class, and a Mensuration Class. These have been fairly attended. A course of lectures was delivered, with one exception, gratuitously, during the past year, by gentlemen of high standing in their several callings, to whom the Society owes its best thanks. The average attendance was about 350. In addition to these, there have been held meetings of a less pretending nature, but still attended with great success, conversations, or smaller lectures, on ordinary subjects, attended with discussion and conversation. Many of the most effective have been given by men employed in the hard work of life, whose daily occupations have left them little time for intellectual research. An Exhibition of Works of Art, and various objects of instruction and interest, kindly lent by the nobility and gentry of Richmond and its neighbourhood, was open for 17 days, and visited during that time by upwards of 7,000 persons. Should a sufficient number of members give in their names, the committee will be glad to arrange during the ensuing winter for a singing class, or other classes according to the demand: and they are especially desirous of forming one for the instruction of adults whose education has been neglected, in reading, writing, &c. With respect to the financial prospects of the Society, the committee have great pleasure in finding that the expenditure is met by the income; they look with confidence to the Society being self supporting; and hope to be able to appropriate something every year to the increase of the permanent Library.

MEETINGS FOR THE ENSUING WEEK.

MON. Architects, 8.
Chemical, 8. I. Dr. Odling, "On the Reciprocal Precipitations of the Metals." II. Mr. J. T. Hobson, "On a New Series of Organo-Thionic Acids."
TUES. Linnæan, 8.
WED. Geological, 8. I. Prof. Owen, "On the Stereognathus Oolíticus from the Stonesfield Slate of Oxfordshire." II. Dr. Buist, "On the Occurrence of Crystallisation in a Stucco-Casting, and on other Instances of Alteration in Molecular Arrangement."
THURS. Zoological, 3.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 24th*, 1856.]

Dated 6th September, 1856.

2076. Sidney Wesley Park and Edgar Stimpson Ells, Troy, New York, U.S.—Improvements in machinery for knitting tubular ribbed fabrics.

Dated 27th September, 1856.

2261. James Holland and John Irving, Manchester—Improvements in the treatment of certain waste woollen yarns or threads, whereby the fibre or wool of which they are composed is rendered capable of being again spun and manufactured.
2263. George Neall, Northampton—An improved union gas stove for lighting and heating.
2267. Frederick Ransome, Ipswich—Improvements in the manufacture of artificial stone, and in rendering it and other building materials less liable to decay.
2269. Joseph Edwards, Liverpool—An improved ships' log. (A communication.)
2271. John Ormerod, Salford—Improvements in machinery or apparatus for bleaching and washing or cleansing textile fabrics and materials, applicable also to the 'soaping' of printed fabrics.

Dated 29th September, 1856.

2273. Jean Francois Victor Larnaudès, 2, Rue Gabrielle, Montmartre, near Paris—An anti-putrefactive and disinfectant.
2275. James Noble Ward, of the Army of the United States—An improvement in the construction of self-priming fire-arms.
2277. Matthew Hickson, Salford—Improvements in waterproofing certain woven fabrics.
2279. Robert Morrison, Newcastle-upon-Tyne—Improvements in the construction of apparatus for lifting, lowering, hauling, and removing moveable articles by the direct action of either water, steam, or gaseous vapour.
2283. Charles William Ramié, Pimlico—Improvements in constructing the permanent ways of railways.

Dated 30th September, 1856.

2285. Thomas Arthur Dillon, Registry of Deeds Office, and John Gray, M.D., 4 and 5, Princes-street, Dublin—An improved means for making signals on railway trains between the guard and driver respectively, and between the passengers and guard and driver, and of giving notice to the guard and driver in case of the accidental severance of the parts of a train, which invention is applicable also to steam ships, factories, and other places where it may be requisite to communicate with distant points.
2287. Samuel Jay and George Smith, 246, Regent-street—A new material to be employed in the manufacture of bonnets, hoods, hats or caps.
2289. Duncan Bruce, Paspebiac, Canada—Making a concentrated animal manure.

Dated 1st October, 1856.

2291. Charles Louis Henri Quentin, 27, Rue des Petits Hotels, Paris—Making a new kind of artificial millstones.
2293. John Dauglish, Great Malvern—An improved method of making bread.
2295. James Begg, Glasgow—Improvements in preparing and bleaching textile fabrics and materials.
2297. John Paterson, Linlithgow, N.B.—Improvements in the manufacture of paper.
2299. Roger George Salter, Alphington, Devon—A method of an apparatus for expediting the stamping or marking of letters, papers, labels, and documents, and improvements in and additions to stamping and marking instruments or apparatus, or in connection therewith.
2301. Charles Durand Gardissal, 10, Bedford-street, Strand—An improved construction of pump. (A communication.)
2303. Edward Wilcox, Harmston, Lincolnshire—Improvements in pumps.

Dated October 2nd, 1856.

2305. Edwin Hardon and Joseph Henry, Stockport—Improvements in looms for weaving, and in machinery for communicating motion to looms and other machines.
2307. Joseph Renshaw, Salford—Certain improvements in machinery or apparatus for cutting or producing the pile of plain or figured velvets or other pile-cut goods or fabrics.
2309. Daniel Desmond, Upper Thames-street—Improvements in vessels and apparatus for storing, improving, and discharging liquids.
2311. Robert Edmeston, Bradford—Improvements in looms for weaving.
2312. Charles Goodyear, Leicester-square—Improvements in securing the openings of air-tight and other bags and packages.

Dated 3rd October, 1856.

2315. Peter Armand le Comte de Fontainemoreau, 4, South-street, Finsbury—Improvements in the construction of roofs of buildings, which improvements are applicable to the construction of arches of bridges. (A communication.)

2317. William Johnson, 47, Lincoln's-inn-fields—Improvements in the treatment, preparation, or manufacture of sheet caoutchouc, and in the combination thereof with cloth and other fabrics. (A communication.)

2319. George Fergusson Wilson and Alexander Isaac Austen, Belmont, Vauxhall—Improvements in the manufacture of soap.

2323. James Allen, Castle-place, Castle-street, Canterbury—Improvements in coats.

2325. Colin Farquharson and William Grimshaw, Mitcham—Improvements in apparatus for indicating and regulating the pressure of steam in boilers.

Dated 4th October, 1856.

2327. Alexis Picard, 39, Rue de l'Echiquier, Paris—An improved tobacco pipe.

2329. Walmsley Preston, Over Darwen, Lancashire—Improved machinery to be used in the manufacture of paper hangings.

2331. Joseph Betteley, Liverpool—Improvements in the manufacture of iron for knees for ships or other purposes.

Dated 6th October, 1856.

2334. Herbert Mackworth, Clifton—Improvements in the separation and treatment of mineral substances, and in coking, and in apparatus connected therewith.

2336. Victor Avril, Paris—Improvements in the manufacture of iron and steel.

Dated 7th October, 1856.

2338. Robert Hazard, 1, Thanet-place, Strand—An improved apparatus for intercepting the smoke and heated gases in its passage from boilers, stoves, furnaces, and kilns, to the chimney, and thereby extracting a portion of its heat, which is made available for drying and warming purposes.

2340. Oglethorpe Wakelin Barratt, Birmingham—Improvements in the dyeing or staining and ornamenting of articles of pearl, bone, and vegetable ivory.

2342. Smith Bottomley, Bradford, and James William Crossley, Brighouse, York—Improvements in the manufacture of pile or nap fabrics.

2344. William Wilkinson, Nottingham—Improvements in castors in the legs of tables, chairs, pianofortes, and other articles of furniture, and in apparatus for perforating castor wheels, which is also applicable to the perforating of glass articles generally.

2346. Joseph Bunnett, Deptford—Improvements in the manufacture of metal sash-bars, columns, and mouldings, for building and decorative purposes, and for a method of protecting the same or other articles from oxydation.

2348. George Fergusson Wilson, Belmont, Vauxhall—An improvement in the manufacture of rosin oil.

Dated 8th October, 1856.

2350. William Ward, Warrington—An improved manufacture of woven fabric.

2352. Francis Whitehead, Crayford, Kent—A method of and apparatus for producing devices in or on wood, leather, and other similar substances, whether for ornamenting the same or for the production of printing and embossing surfaces therefrom.

2354. William Bradford, Manchester—Improvements in the arrangement of gas burners for lighting and ventilating.

2356. Daniel Foxwell, Manchester—An improved mode or method of consuming smoke and economising fuel thereby.

2360. Henry Watson and John Dixon, High Bridge Works, Newcastle-on-Tyne—Improvements in cocks and valves.

2362. François Julien, 4, Trafalgar-square—Improvements in ordnance or cannon.

Dated 9th October, 1856.

2364. Thomas King, Spitalfields—An improved continuous compressing machine.

2366. George Hallen Cottam and Henry Richard Cottam, St. Pancras Iron Works, Old St. Pancras-road—An improvement in the manufacture of iron hurdles.

2368. William Nairne, Aberdalgie, near Perth—Certain improvements in the machinery for preparing flax, tow, and other fibrous substances.

2372. James Saul Hendy, Essex-street, Strand—Improvements in fire stoves or grates used for domestic purposes.

Dated 10th October, 1856.

2376. William Johnson, 47, Lincoln's-inn-fields—Improvements in railway brakes. (A communication.)

2378. Frederick Albert Gatty, Accrington—Certain improvements in dyeing.

2380. William Rennie, jun., Lagan Foundry, Belfast—Improvements in the condensing apparatus of steam-engines.

Dated 11th October, 1856.

2384. William Caswell Watson, New York—Improvements in sewing machines.

2386. George Heppell, Uttoxeter, Stafford—Improvements in ventilating mines and other like places.

2388. Alfred Vincent Newton, 66, Chancery-lane—A new gaseous liquid to be used in generating motive power. (A communication.)

2390. Gustav Scheurmann, Newgate-street—Improvements in printing music when type is employed.

Dated 13th October, 1856.

2392. George Elliott, Newcastle-upon-Tyne—Improvements in the production of oxides of manganese.

2394. William and Jacob Todd, Heywood, Lancaster—Certain improvements in power looms for weaving.

2396. Claude Eugene Mony, Paris—An improved mode of transmitting motive power.

2398. John Roscow, Radcliff, Lancaster—Certain improvements in machinery or apparatus for cutting or rasping dye woods.

Dated 14th October, 1856.

2400. Richard Sumner, Droylesden, Lancaster—Certain improvements in power looms for weaving.

2402. Samuel Bremner, Newcastle-upon-Tyne—Improvements in pouches or envelopes, and in machinery or apparatus for manufacturing or producing the same.

2404. Thomas Stokes Cressey, High-street, Homerton—Improvements in machinery for cutting, hollowing, and backing staves.

Dated 15th October, 1856.

2410. Bennett Johns Heywood, Hawley-road, Camden town—Improvements in valves for inflating air-tight bags, cushions, and other similar articles, and for drawing off liquids.

2412. John Palmer, Stockton-on-Tees, Durham—Improved machinery for separating different kinds or qualities of seed and grain from each other.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

2382. Timothy Gilbert, Massachusetts, U.S.—An improved pianoforte action or string-sounding mechanism. (A communication.)—10th October, 1856.

2407. Joseph Henry George Wells, 45, Essex-street, Strand—Improvements in windlasses. (A communication.)—15th October, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed October 24th, 1856.

980. Alex. Southwood Stocker.
981. Abel Désiré Schratz.
1000. Edmund Topham.
1034. Richard Archibald Brooman.
1037. Augustus Smith.
1058. Isaac Holden.
1068. Richard Archibald Brooman.
1083. Conrad William Finzel, William Needham, and John Barton.
1084. Richard Archibald Brooman.
1085. Alexander Alliott.
1102. Richard Archibald Brooman.
1103. Richard Archibald Brooman.
1104. Fred. Richard Laurence.
1185. John Wilkes, Thos. Wilkes, and Gilbert Wilkes.
1206. Alex. Allan and Thomas Hunt.
1258. William Edward Newton.
1365. John Henry Johnson.
1498. James Platt and John Whitehead.
1530. Samuel Jabez Goode.
1572. Robert Luke Howard.
1868. John Woodman.
1958. George James Farmer.

Sealed October 28th, 1856.

1011. William Denny Ruck.
1015. Thomas Greenshields.
1018. Isaac Abraham Bass.
1024. Joseph Rigby.
1025. Louis Jean Baptiste Mauzy.
1026. Wright Jones.
1036. Samuel Hunter.
1044. Alexander Gordon.
1050. Peter Armand le Comte de Fontaine-moreau.
1060. William Gregory.
1363. Charles William Siemens.
1404. Servans de Jong.
1615. David Fisher.
1711. William Papineau.
1873. Diederich Fehrmann.
1903. William Morgan.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

October 21st.

2610. Edward Gregson Banner.

October 22nd.

2463. Alfred Vincent Newton.
2493. Joseph Gurney.
2526. John Whitehead and Thomas Whitehead.
2544. James Howard.
2587. Alfred Vincent Newton.

October 24th.

2466. Charles Goodyear.
2473. Edward Joseph Hughes.

October 25th.

2476. Patrick Benignus O'Neill.
2486. George Edward Dering.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3891	Oct. 17.	Door Spring	Thomas Pemberton and Sons.	Birmingham.
3892	„ 17.	Improved Corn Shovel	Smith and England	Wollaston Works, Stourbridge.
3893	„ 22.	Chimney Top	Thomas Large Hemley	Calne, Wilts.
3894	„ 23.	The Ladle Pickle Fork	Alfred John Marriott	237, Oxford-street.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 7, 1856.

CLASS BOOKS FOR INSTITUTIONS.

The following letter has been received from the Secretary to the Committee of Council on Education :—

"Education Department, Downing-street,
"London, Oct. 30th, 1856.

"Sir,—In pursuance of the letter from this office of the 15th instant, I have the honour to enclose copies of—

"1. An explanatory circular.
"2. A form of preliminary return.
"3. A form of application,

adapted specially to the classes of instruction which are connected with Mechanics' Institutes.

"My Lords will undertake to send copies of these documents to the correspondents of the Institutes in connection with your Society, if you will have the goodness to furnish me with a list of the names and addresses.

"I have the honour to be, Sir,
"Your obedient servant,
"R. R. W. LINGEN."

"P. Le Neve Foster, Esq.,
"Society of Arts, Adelphi."

The following is the explanatory circular alluded to, and is addressed to the Managers of all the Institutions in Union with the Society of Arts :—

"Education Department,
"Privy Council Office, Downing-street.

"Gentlemen,—In compliance with a request received from the Society of Arts, I am directed by the Committee of Council on Education to afford to your Institution an opportunity of obtaining the books, maps, and diagrams enumerated in the accompanying schedule, at the reduced prices therein specified.

"In determining the works to be put upon the list, my lords reserved to themselves the liberty of rejecting any work which by its subject matter did not appear to them to be suitable for *elementary instruction in school;* but they have not gone further than this into the merits of any particular work.

"The difficulty of school managers does not consist in providing the means of reference to works of comparatively expensive character, but in putting *class-books into the hands of each scholar, and furnishing the school with large maps and diagrams for class-teaching.* It is to such works, and to suitable text-books for masters and assistants, that my lords desire to confine the list.

"Those books which are thought to be more suitable to teachers than to ordinary scholars are distinguished by an asterisk.

"You will observe that the point of view from which my lords are able to regard your Institute as falling within the scope of the Committee of Council on Education is *the means which it affords for regular and systematic instruction at prescribed times, under regularly attending teachers.* Their lordships are well aware that this instruction forms only a part of the public service which you are endeavouring to render, nor do they undervalue the importance of those occasional lectures by persons of special qualification, nor those opportunities for individual reading and study, which your Institute affords to its members. Such parts of your system, however, suppose adults educated, or capable of educating themselves, suitably to their condition in life, and are properly left to independent local action. But in order to create this educated class, or this class capable of perfecting its own education, former short-comings of instruction must be made good by steady application under competent teachers. *In this respect, you are promoters of schools,* though not altogether of the common kind; and in this respect my lords are anxious to place at your service all those parts of their machinery which you can use without departing from the ground of self-support—a principle never to be lost sight of where adults chiefly are concerned.

"In troubling you to fill up the form[*] which accompanies this letter my lords have two principal objects in view. First, they wish to bring "classes for instruction" into prominence as an integral part of the work of a Mechanics' Institute, and to fix the attention of the managers upon the details of such classes. Next, although the return may, in the first instance, often be little more than a rough and imperfect estimate, their lordships wish to suggest the propriety of keeping accurate records, as the basis of a valuable body of information. The Census of 1861 may be expected to embrace education among its objects, but it can only do so with complete effect if due preparation be made by the promoters of education beforehand.

"The prices entered in the schedule are, upon an average, 40 per cent. below the ordinary retail prices. The power of purchasing through the medium of the Committee of Council gives your Institute the full benefit of this reduction on the part of the publishers. The only cost beyond that of the works themselves will be the carriage of the parcel from London.

"*No applications can be entertained oftener than once in each year, nor in respect of books, maps, and diagrams costing less than £3.*

"The managers may, at their discretion, retain the works as the property of the Institution, allowing the teachers and scholars to have the use of them, or they may sell them again to such teachers and scholars at any price not exceeding that named in the schedule.

"The Committee of Council strongly recommend that the scholars be encouraged to purchase in this manner *for themselves* such works as the teachers may direct to be used.

"If, as managers of the Institute, you desire to obtain books, maps, and diagrams through the agency of the Committee of Council, you will be so good as to write to this office for the form of an "*Application to purchase,*" and to enclose in your letter a copy of your rules and of your last published report, together with a return in the accompanying form.

"If the form can be filled up, my lords will be glad to receive it; but if the form cannot be filled up without considerable inconvenience, it may be omitted, and the other documents will, for the present, suffice. My lords hope, however, that the importance of being able at all times to make exact returns will not be lost sight of by the managers of these classes.

"I have the honour to be, Gentlemen,
"Your obedient servant,
"R. R. W. LINGEN.

"To the Committee of Management
of the above-named Institute."

EXAMINERS' REPORT.

Subjects and Suggestions for Candidates in June, 1857.

The Board of Examiners, at the request of the Council of the Society of Arts, have drawn up the following instructions, suggestions, and recommendations for the use of those persons who propose to present themselves for examination before the Society's Examiners.

The text-books mentioned in the following pages are sanctioned by the Board of Examiners.

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[*] This form is for the purpose of obtaining certain statistical details of the Institution and its classes.—Ed. S. A. J.

Mathematics.

The Examiners in Mathematics recommend that the mathematical course should comprise:—

Arithmetic.

Knowledge of the principles of a decimal currency on the basis of the pound unit.

Book-keeping by double entry.

Algebra, including Quadratic Equations, and the Theory and Application of Logarithms. Elements of Euclid, books I., II., III., and VI., XI. (first 21 propositions), and XII. (first 10 propositions).

Mensuration.

Plane and Spherical Trigonometry, with the solution of both plane and spherical triangles by the use of Logarithmic Tables.

Land Surveying.

Nautical Astronomy.

The properties of Conic Sections treated geometrically or graphically, by the method of projections.

The Examiners do not attach much importance to the selection of the manuals in which mathematics may be learned. Such text-books as those of Colenso, or Barnard Smith in Arithmetic and Algebra, the Arithmetic and Trigonometry of the Society for the Promotion of Christian Knowledge, "Mathematical Tables" (*Chambers' Educational Course*), and the "Elements of Descriptive Geometry" (*J. W. Parker, Strand*), may be recommended. The Examiners will consider of no moment a familiarity with technical rules, got up as exercises of the memory. A knowledge of the principles involved in the subjects of examination, and a facility in applying them to particular cases, will alone be valued.

They strongly recommend students, who take an interest in the practical applications of Geometry, to master the principal propositions in the Eleventh and Twelfth Books of Euclid.

The Examiners desire to impress on the notice of the candidates, the importance of making themselves acquainted with methods of investigation and principles. They believe that much valuable time is lost over curious problems, which have nothing to recommend them but their difficulty, and in solving Algebraical equations, which require nothing but expertness in manipulating symbols.

The Examiners are of opinion, that a candidate, by directing the course of his reading this way, with no greater expenditure of time than at present is given to acquiring a knowledge of the rudiments of Mathematics, might obtain some acquaintance with the principle of Duality, learn something of the method of Poles and Polars, of Transversal Lines, and acquire some familiarity with the elementary principles of solid and descriptive Geometry, and of the methods of Projection applied to derive the principal proportions of the Conic Sections from the circle. To solve algebraical equations or geometrical problems is seldom required in the business of practical life. The Examiners will be prepared to test the candidates by an examination conducted in principles and methods which may be obtained by careful reading, rather than by setting curious puzzles, to tax the ingenuity of the candidate.

Physics.

The Examiners in Mechanics would particularly direct the attention of Candidates to the importance of obtaining a clear knowledge of the general principles on which all machines must be constructed. They are of opinion that this knowledge, though at first it may seem abstract, will in the end prove of far more value to the intelligent engineer than any early familiarity with the construction or working of individual machines. When the mind once lays fast hold of a general principle, it becomes a very easy matter to apply it as circumstances may arise. The uninstructed workman, after the familiarity, it may be, of years with the working of machinery in motion, comes at last to gather the general principle from a life-long induction of particulars. He invents for himself a theory of mechanics. Had he been properly instructed, he might have started where he ends. The Examiners will endeavour to test the Candidates' knowledge of general principles applied to the construction of ordinary and familiar machines.

The Examiners in Physics desire to direct the attention of Candidates to the Study of the Properties of Heat, a knowledge of which is of so much importance to the right understanding of the action of the great motive power Steam, the construction of furnaces, and the economical consumption of fuel. The principles involved in the theory of Hydrostatics are of daily practical application. Indeed, there is no knowledge of a general principle, or acquaintance with a particular physical fact that may not sometime or other be turned to account.

The Examiners in Mechanics and in the Natural Sciences recommend that the course should comprise:—

The Elements of Statics and Dynamics.

The Principles of Mechanism.

Practical Mechanics.

Hydrostatics.

Pneumatics.

Electricity.

The Theory of Heat, especially with reference to the properties of steam.

The Examiners recommend the separate treatises by Galbraith and Haughton, Lardner's Handbooks of Natural Philosophy, and Brooke's edition of Golding Bird's Elements of Natural Philosophy.

The Examiners desire it to be distinctly understood that they can assign very little value even to correct answers, when unaccompanied by a demonstration, if practicable.

They view the habit of accurate inductive reasoning to be an important secondary advantage accruing from the study of Mathematics and Physics.

Chemistry.

The Examiners in Chemistry desire to point out for the guidance of students the following books:—Professor G. Wilson's Chemistry (*Chambers' Educational Course*); Fownes' Manual of Chemistry (*Churchill*); Dr. Gregory's Handbook of Chemistry, Organic and Inorganic, 2 vols.; and Professor Miller's Elements of Chemistry.

Agriculture.

The Examiners in Agriculture recommend the following works to the attention of Candidates:—

Johnson's Agricultural Chemistry.

Morton's Cyclopædia of Agriculture.

British Husbandry. S.D.U.K.

Low's Elements of Practical Agriculture.

Stephens' Book of the Farm.

The Examiners will require such a general knowledge of Farm Practice and the Management of Live Stock as must to some extent at any rate have been obtained in the field.

Political and Social Economy.

The importance of the knowledge implied under this head, and the very general ignorance which pervades the great mass of the public, as to the application of its principles to the every-day business and the ordinary relations of common life, have induced the Council to recommend to the Board of Examiners to add Political and Social Economy to the list of Subjects for Examination. The phenomena of industrial life, and the obscure but fixed laws which rule the international and social intercourse of men living in communities, have been too much overlooked and disregarded.

The Examiners recommend the following text Books on this subject:—

Adam Smith's Wealth of Nations.

Archbishop Whateley on Value.

Lessons on the Phenomena of Industrial Life, edited by the Dean of Hereford.

GEOGRAPHY.

I. The Examiners recommend that all Candidates for Certificates in Geography should acquire a sufficient stock of systematic information in elementary descriptive geography as a basis, before they proceed to the study of the more scientific branches of the subject. With this view they should qualify themselves to undergo a searching examination in such a book as William Hughes' "Geography for the use of beginners" (*Gleig's Series*). Success in this limited portion of the subject will qualify a Candidate to obtain a Certificate of Competency.

II. To those who already possess a good general knowledge of descriptive Geography, the Examiners suggest, as a special subject for the present year, a thorough study of the Geography of the British Empire and its dependencies.

The student will be expected to acquire, in regard to each part of the British Dominions—

1. An exact and minute acquaintance with its Descriptive and Political Geography.
2. An elementary knowledge, sound as far as it may go, of its Historical Geography.
3. Such acquaintance with its Physical Geography as may bear on the chief natural productions and on the condition of its inhabitants.

Candidates who pass a satisfactory examination in the range of knowledge which has been indicated, will be entitled to a Certificate of Proficiency.

III. The more advanced study of Geography is so extensive in its connexions, that the examiners would recommend candidates to take up some one or two branches of the subject, rather than to pursue a more diffusive course. They consider that a student who has well mastered the elements of Geography, will get most advantage by a careful study of some one of the following sciences, taken strictly in its Geographical relation; that is, *in its bearing on the condition of the human race.*

a. Zoology.
b. Botany.
c. Geology.
d. Meteorology.
e. Ethnography.

As a special subject for the ensuing examination, the Examiners have fixed on Geology. They will be prepared to award a Certificate of Excellence to any candidate who may add an acquaintance with that science, *considered in its purely geographical relation*, to an extensive and sound knowledge of general descriptive geography.

The Examiners recommend all candidates diligently to study common maps, and to obtain a facility of drawing with clearness and precision, from memory only, maps of the principal countries, seas, and islands of the globe, so as distinctly to show the chief natural features and the situations of the principal towns. They prefer a style of map drawing in which the mountain chains and coast line are neatly and easily indicated, by mere lines, instead of that in which the usual style of engraved maps is imitated, which occupies much more time and possesses no practical advantage.

The following may be named as comprehensive compendiums.

Somerville's Physical Geography, 2 vols.
Guyot's Earth and Man.
William Hughes' Geography, 2 vols.

ENGLISH LITERATURE.

The Examiners in English Literature noticed in the last examination, that some of the candidates sent in a large number of answers to the questions given, some of which were superficial and wanting in accuracy.

To prevent a recurrence of this, it is intended in future to limit the examination of each candidate to any *two* of the authors on the schedule, which he may select for himself.

The examination in these two subjects will be rigid. The scope and tendency of the work under consideration, its peculiarities of style, its relation to contemporary literature, its influence on society, and the biography of its author, will form the basis of the examination. The candidate will also be expected to define the position of the writer in respect to his contemporaries, the probable sources from which he derived his materials, and the influence exerted on him by the age in which he lived. Some knowledge also of the great epochs and divisions of English literature will be required.

An acquaintance with all or the most important of the works of the two authors selected will be *useful;* a thorough knowledge of the two works specified will be *indispensable.*

The Examiners recommend the candidate to pay great attention to the exact meaning of the words of the author he is studying. They would advise him not to shrink from the trouble of registering on paper the more important words in an orderly and systematic manner, or from endeavouring to develop step by step the various meanings in which those words are used, and the chain by which their meanings are bound together.

As there may be some danger that such an exercise, useful as it is, may superinduce a mere love of verbal subtleties, instead of an honest desire of discovering the full meaning of the author, the Examiners think it advisable to vary this exercise with another. They would recommend that by frequent reading and analysis the student should endeavour to master the mind of his author, to understand the order in which the work develops itself, to trace the connection between its several parts, with their relation to each other and to the great end which the author had in view. This, it is true, is not to be accomplished without great labour, but the student has this encouragement, that the insight, however small, which he gains by this method into the mind of a great writer, will be of more value for his own self-improvement than any amount of opinions gained from others, with which he may load his memory.

The following is the course on which the next examination will take place. Chaucer's Prologue to the Canterbury Tales. Spenser's Fairy Queen, First Book. Shakespeare: King John, Henry IV., Hamlet, Macbeth. Bacon: First Book of the Novum Organum in English (*Bohn*); the Advancement of Learning. Milton's Paradise Lost, First Six Books. Dryden: Virgil's Æneid, First Six Books. Spectator. Pope: Homer's Iliad, First Eight Books. Butler's Analogy (*The Religious Tract Society's Edition*), with the Introduction, and the Three Sermons on Human Nature. Wordsworth: Excursion, or Lyrical Ballads. Tennyson.

Candidates may take up any two, but not more than two of the above authors.

ENGLISH HISTORY.

Although the Examiners in English History have reason to feel satisfied at the results of the last examination, yet they feel it their duty to offer the following suggestions for the guidance of future Candidates.

I. In commencing the study of English History, it will be advisable for the student to divide the whole subject into epochs. These will be, the Roman, Anglo-Saxon, Norman, Plantagenet, Tudor, Stuart, and Hanoverian. Before he proceeds to examine each of these epochs in detail, he will find it useful to gain *some* information of the countries, races, and people to which they respectively point; and he is to connect these important topics of inquiry with his peculiar historical studies.

II. In studying each of these epochs (if possible, consecutively), he is advised to proportion his attention to their relative importance; and to adopt the same caution in reference to the events and the reigns embraced in each single epoch. Instead of bestowing the same degree of labour on the reign of each single sovereign, he is rather to select the most conspicuous sovereign in each dynasty and each epoch, and take that sovereign's reign as a guide and illustration for the rest. He is to follow the same rule in every single reign; beginning with studying carefully the great and prominent facts of the reign, considering them as the indices to guide him to the true understanding of the more dubious and obscure. Thus in his historical studies he is to adopt the common rule of prudence, determining minor facts and less important characters by the greater and the more illustrious; not the greater and more illustrious by the more questionable and obscure.

III. Although the examiners think that a special illustration of these remarks is in some measure beyond their province, and might possibly narrow the application of them, yet that their meaning may be more clear, the following details are subjoined:—

Of the various epochs aleady mentioned, 1st, the Roman, divides itself into two. The first period extends from the invasion of Julius Cæsar to the time of Julius Agricola, and is occupied in the subjugation of the island. The second is the civilised Roman period; when Britain became a province like other portions of the Empire. 2ndly. The Anglo-Saxon divides itself into Pagan and Christian. 3rdly. The Norman, ending with Stephen, also is divided into two; the Conquest of England under William, and the union of the two races in the marriage of Henry I. 4thly. The Plantagenet King derived from a different part of the soil, is, from his local position, interested in other questions than the Norman; yet in relation to his English as well as his French dominions, he carries out the great principle of his race. Either like Henry II. he is asserting the laws of the Crown against the laws of the Clergy, as in the controversy with Thomas à Becket; or, like John, the rights of the Sovereign against the Pope. And when, by surrendering the crown, the king had forsaken this principle, he brings out the nation to assert its rights against himself and the Pope. Under Henry III., by a similar vacillation and bad faith, the necessity is shown of a *permanent* expression of the national mind, in the House of Commons. In Edward I. the King prosecutes a *legal* claim to Wales and Scotland; or in Edward III. a similar claim to France; the same principle is the object of all. Then follows the gradual breaking up of that dynasty and the whole mediæval epoch of English History, from the usurpation of Henry IV. to the union of the two houses in Henry VII., and the total loss of all those foreign possessions during the tenure of which every king from the Norman Conquest was, while a native to one part of his dominions, a foreigner to the rest.

The nation is then drawn round the Tudor king more closely and compactly. His new position and his past experience bring out a new principle, held by all the Sovereigns of this House, but asserted by all in a different way; viz., their Royal Supremacy. It is asserted by Henry VII. against the nobles; by Henry VIII. against the Pope and ecclesiastics; by Elizabeth against both; and even by Mary her sister, against her Protestant subjects. The tendency of the whole policy of the Tudors is domestic; but the love of display in Henry VIII., in Elizabeth the assertion of nationality against Philip II. caused these sovereigns, even against their will, to interfere in the general politics of Europe.

A different dynasty commences with the Stuarts, ending with the union of Scotland and England; that is the great result to which all is tending throughout the reign of James I. and his successors; and its importance cannot be over-rated. Under the Stuarts the Royal Prerogative is the great point of discussion. Its formal assertion provokes a similar assertion on the part of other bodies in the nation. In the reign of James it affects the Parliament; in the reign of Charles I. every person in Parliament or out of it; Charles II. is not too careless to exercise it on special occasions; James II. makes it subservient to his religious designs. It is limited under William III., and almost forgotten under Anne.

The accession of the House of Hanover brings the nation once more, after a long interval, into closer relations with the Continent; not with France, as in the Norman and Plantagenet eras, but with Germany. At the close of the reign of George the Third, the nation is ruled by ministers who do not put forward the Supremacy, still less the Royal Prerogative, but "court influence." The great reign of this dynasty is that of George III., the great event "the American Independence;" opening the eyes of the nation to a sense of its responsibilities and duties, and securing it from fatal errors which plunged other countries into revolution. We have a more enlightened and philosophical statesmanship from that era, which has preserved to England its national supremacy, and rendered fruitful all past national experience.

To ascertain the true order of events and not to substitute one of his own, the student must adopt some such method as the one just pointed out. He must study the meaning of the great facts in history, endeavour to discover their relation to one another; and perhaps the most feasible method he can pursue, after mastering the great outlines and divisions of his subject, will be to examine the particular reigns of the most remarkable sovereigns, as here suggested.

For ordinary books he may be left to his own discretion; for reference he will find the following useful. For Constitutional History, Hallam's Middle Ages and the Constitutional History of England; for Historical Epochs and their connexion with Geography, Spruner's Atlas or Brewer's Atlas, or some similar works.

In conclusion, though the Examiners have thrown out the foregoing suggestions, they by no means wish to bind any candidate to the method here pointed out. Much must be left to the constitution of every man's mind; and they will endeavour to test every candidate on his own merits, by the care, ability, and faithfulness with which he has worked out his line of study, and not by any preconceived notion of their own.

N.B. For the year 1857, *the Examiners will require Candidates to show a fair knowledge of the general outlines of English History, throughout the periods specified in the foregoing report. For the special subject of Examination, they have determined on the Stuart dynasty, from the commencement in* 1605, *to the Restoration in* 1660.

Roman Literature and Latin.

The Examiners in Latin and Roman Literature will examine in Cicero's Orations against Catiline, and in the first book of the Æneid of Virgil.

In Roman history they will examine to the end of the Punic wars, or from that date to the death of Augustus Cæsar. The usual text books on these subjects, such as the Histories of Keightley, W. Smith, Schmitz, and those in Gleig's series, will suffice.

French.

In the French Language and Literature the Examiner names the following works in which he will examine:—Pascal, Lettres Provinciales; Racine, Britannicus; Molière, le Bourgeois Gentilhomme; Boileau, le Lutrin; C. Delavigne, Louis XI.; Guizot, Histoire de la Civilisation en Europe.

Candidates may take up *any two, but not more than two*, of the above works, and must be ready to answer any grammatical, literary, or historical questions the text may suggest.

In French History the Examiner will require a sketch of the Reigns of Clovis, Charlemagne, Charles VII., Francis I., Henry IV., and Louis XVI.

Drawing.

For principles of Freehand Drawing, students should read "Rudimentary Art Instruction, for Artizans and others, and for Schools;" prepared at the request of the Society for the Encouragement of Arts, Manufactures, and Commerce; Freehand Outline, part I. Freehand Outline, part II.—(*Bell and Daldy*).

With reference to Practical Drawing, directly applicable to Carpentry, Iron work, Pattern Making, Machinery, &c., the Examiners will require the Candidate to represent in outline the simple geometrical solids; their elevations, sections, plans and perspective according to the dictation of the Examiner. The following books may be consulted with advantage:—Butler Williams' Treatise on "Geometric Drawing and Perspective." (*Parker*, Strand, 1841). Drawing Vol. II. (*Chambers' Educational Course.*)

German.

The examiner in German gives the choice of two of the following works:—

Schiller's Maria Stuart, Wallenstein (the three parts), and Geschichte des dreissigjährigen Krieges; Göthe's Egmont and Torquato Tasso; Kugler's Geschichte Friedrich des Grossen.

He would, at the same time, advise the learner to apply, as far as possible, to the study of any of these books the very judicious recommendations given in this paper by the examiners in English literature.

Candidates for a first class certificate will be required to write an Essay on any portion of the works they may have selected, in good German. Those for a second or third class may give their answers in English; but they must be able to translate a piece of easy prose into German.

None need employ the German characters, unless they write them very legibly.

THE SOULAGE COLLECTION.

(From the *Times*.)

The habitual lounger in our London streets cannot fail to have noticed the great increase which has taken place of late years in the number of old curiosity shops—receptacles for all that world of objects so dear and so familiar to collectors, under the comprehensive designation of *virtu*. From the common old-fashioned teapots which our great grandmothers may have delighted in, and our grandmothers, when children, may have done their best to annihilate, to the groups and vases which may have been treasured up among the princely appendages of the wealthiest Courts of Europe, from Delft to Sèvres—from Rundell and Bridge to Cellini—from the squat old Dutch and Flemish corner cupboards and sideboards which figure in the pictures of Jan Stein and Terburgh, to the finest commodes, secretaires, and gueridons of Boule and Reisner—from the coarsest church lace, wrought by the rustic inmates of poor and out-of-the-way convents in Italy and Spain, to the artful cobwebs of Mechlin, Brussels, and Chantilly—from the punchy green glass goblets, out of which the cavaliers of Palamedes and the boors of Brouwer and Ostade alike continually quaff, to the gilt and enamelled tazze, Vitro di Trino, and latticinio of Venice, specimens of all that has most strenuously exercised the technical ingenuity of the art-workmen of past ages may be found gathered together in such shops by that infallible loadstone, the hope of profit—for acquisition by our wealthy, and for the receipt of admiration from those among us, whose "poverty but not their will consents" to forego the possession and enjoyment of such household gods. Trumpery as the majority of objects comprised within the limits we have sketched may appear at the first glance to the utilitarian, a little further observation and reflection would probably convince him that the eagerness to acquire something superior to common-place and current ugliness in household appurtenances, which now unquestionably obtains among the public, is no unimportant indication of that improvement in demand which can alone lead to permanent improvement in supply. It is utterly vain for teachers to teach, lecturers to lecture, inventors to invent, manufacturers to manufacture, and designers to design a hundred-fold better than they have hitherto done, unless the great mass of the educated public can be brought to show an interest, sympathy, and pride in the results of their efforts. It is a matter of no slight importance that the thousands—and there are thousands—who take their daily lessons in taste from shop windows, should have such shop windows as now swarm in our principal thoroughfares to learn from. If, then, as we believe, much and material improvement is derived in this casual way, and from the observation of such miscellaneous relics of the good taste of our forefathers, how much more must be gained by the thousands who linger, at once amused and instructed, over the treasures of Marlborough House—treasures collected and displayed with a zeal, liberality, and discretion which may be set in exceedingly favourable contrast to the system which has prevailed until very recently in the management of our other national collections? When it is remembered that only five years ago the nucleus of the museum was formed by the expenditure of the grant of only £5,000, under the auspices of a committee appointed by the Treasury; and when it is found at the present date to rival the celebrated Hôtel Cluny of Paris, and far to excel in range of illustration any other public institution of an analogous character in Europe, it may be regarded as a theme for congratulation that so much has been done to retrieve the reputation for a veneration for the beauties of the past, which we, as a people, had well-night lost among the nationalities of Europe. While France had purchased for the instruction of her artists and workmen the Revoil and Du Sommerard Collections, and formed her Musée Ceramique at Sèvres, thereby sowing seed which has brought Paris infinite treasure, and laid the foundation of a rare excellence in art manipulation; while Bavaria could boast her Vereinigten Sammlungen; Prussia, her Kunstkammer; Saxony, her Grüne Gewölbe and Zwinger; Austria, her Ambras and Schatzkammer museums—England alone appeared indifferent to the advantages of concentrating for public exhibition the treasures of art workmanship which abounded in the cabinets of her individual connoisseurs.

* * * * * *

It appears some thirty years ago a certain French gentleman, M. Soulage, of Toulouse, was bitten with a mania for collecting objects of beauty in the art-workmanship of the Italian Renaissance—that is to say, such articles as, while ministering to the luxuries of the patricians of the 16th and 17th centuries, should have been wrought in more or less direct imitation of those supposed to have been essential to the enjoyment of the same class under the auspices of Imperial Rome. The moment at which the mania of M. Soulage broke out was a propitious one for its economical indulgence. That terrible time, that *tempo dei Francesi*, which in Italy is made to account for the disappearance of thousands of precious heirlooms, which the fears, or necessities, or cupidity of their proprietors had led them to more or less secretly dispose of, had passed away, just long enough to embolden those into whose hands much miscellaneous plunder of past greatness had fallen, to produce from cellars and garrets fragments of princely magnificence, for their present possession of which they might not very possibly be strictly called to account. To sell to a foreigner who would pay ready money, and at once take away with him, objects marked with the arms and badges of the great families whose descendants were still the influential people of the locality, offered, no doubt, a great temptation to the Italian brokers, and thus M. Soulage was enabled to carry off many a piece of tarnished grandeur enriched by the names of the Malatestas and Gonzagas, the Visconti and the Borgias, the Orsini and the Brancaleoni. His spoils differ in one essential particular from those of the majority of other collectors. With him art was everything, intrinsic value nothing. Including a few gold medals and small articles in silver, his whole series of 790 specimens, if brought to the melting pot, would realise probably little more than as many shillings, and yet we are assured, on the very competent authorities of Mr. John Webb and Mr. J. C. Robinson, curator of Marlborough-house, the sum of £11,000 is a very moderate estimate of its present market value. Bronze, earthenware, stone, wood, and glass comprise almost the whole series of materials, and the skill of the artist has alone effected the magic transmutation of the whole to gold. This fact should teach no trifling lesson to those who order and value "testimonials" by the number alone of ounces of silver they weigh, or appreciate household furniture alone by the quantity of cube mahogany contained in each piece. Except in the single article of majolica, there is little in common between the Bernal and the Soulage collections; for while the former abounded in miscellaneous objects remarkable only for curiosity, gleaned apparently for the most part between Wardour-street and the Low Countries, the latter is apparently limited to Italian art of the best period of the cinque-cento. The Bernal, with much that was excellent, blended a vast quantity of toys and trifles; the Soulage is for the most part made up of fine large objects, almost every one of which furnishes a model for what might be actually used for household or domestic purposes in the present day.

The unique feature of M. Soulage's accumulations is unquestionably the collection of 106 gold, silver, and bronze medals of illustrious men, for the most part Italians of the 14th, 15th, and 16th centuries. Such medals served for the badges of various families, and were worn in the sleeves, round the necks, or on the hats of gentlemen following the fortunes of a noble house. The best art of the period was invariably employed upon them, and they were modelled, cast, and chased up by men no less skilful than Vittore Pisano (il Pisanello), his scholar Matteo Pasti, Francesco Francia, Pollaiuolo, and Cellini; the latter being among the earliest makers of steel dies to supersede the more troublesome process of casting and finishing up each individual medal separately. Admirable likenesses these medals must have been, for rarely do they fail to express the stamp which history has set upon the characters of men of whose outward semblances time has spared us no other vestige than the record contained in these most interesting medallions.

In money value the richly carved furniture bears away the first place, and it certainly contains many priceless objects. Among the most beautiful are two of those splendid marriage chests immortalized in Rogers's legend of Ginevra. A fireplace ascribed to Alfonso Lombardo, but more probably by one of the Milanese sculptors, is a miracle of stone carving. Among the fifty-one chairs are many of great beauty, and four, enriched with the tarsia, or marquetry, for which Tuscany was early celebrated, and marked with the badge, and are certainly of the period of the renowned Guid' Ubaldo, of Urbino. Strange to say, one of the articles of domestic use upon which the richest carving was most habitually lavished was the bellows. Every collection of importance can display a specimen, but the Soulage has no less than three, and among them the finest known. Another point upon which it takes a strong position is in its possession of a series of original steel mirrors in exquisitely carved frames of the greatest rarity. One, traditionally alleged to have belonged to Lucrezia Borgia, is particularly fine; and others, bearing the badges of the Malatestas and the Viscontis are scarcely less remarkable. The spoils of Doges shine conspicuously, and the great lantern of Gradenigo is a splendid specimen of wood carving.

Next in value to the furniture comes the majolica, that triumph of Italian potters, the favoured ware of the ducal family of Urbino. To the great Maestro Giorgio Andreoli no fewer than fifty pieces are ascribed, and in all the collection comprises, in vases, figure pieces, salts, and dishes, as many as 165 specimens, and among them many by Orazio Fontana and Durantino. On one of the plates is a portrait of Pietro Perugino, executed probably within a short period of his death, and possibly by one of his scholars. The plates with metallic lustre are unusually numerous and fine, in proportion to the whole number of specimens. With the exception of the majolica and of a few excellent specimens of Bernard de Palissy's singular and graceful ware, two good bits of Luca della Robbia's, and a fine vase of Spanish or Majorcan manufacture, the collection contains nothing of great importance in the way of ceramic art.

More valuable even than the pottery, so far as the importance of the practical lessons derivable from it is concerned, is the sumptuous series of bronzes; not that we meet with any of those exquisitely patinated statuettes which rival the purest antique, and which from the days of their original execution connoisseurs have all but poisoned one another in their avidity to possess, but that in quantity and nobility of style the Soulage specimens present us with a true and fair picture of the part that bronze was made to play in architectural and household decoration in the palmiest days of Florence, Padua and Venice; not even the well known "Pisani Neptune Knocker" of the last named city is finer than the magnificent specimen ascribed, with every appearance of probability, to John of Bologna. The firedogs and fireirons from the Brancaleone Palace are full of suggestion, as are other and yet nobler objects of the same kind. Many interesting illustrations in vases and plateaus are brought together of Venetian proficiency in the art of damascening,—an art caught up by the skilful artisans of the "fair city of the sea," from the traditions of Mossoul and Damascus. It is not to be expected that in such a collection the exquisite glass *tazze*, which have made the name of Murano famous for all time, could be omitted. We accordingly find that it includes nearly 100 pieces, of which nineteen are gilt and enamelled; while, as though to complete the picture of a sumptuous apartment in the Palace of a Grimani or a Mocenigo, involuntarily called up to the mind's eye by the profusion of Venetian magnificence scattered about, as from the cornucopia of a Paulo Veronese, there hangs a noble chandelier with glassy flowers of the genuine old stamp. That hangings of right Baudekyn (Baldacchino) may not be wanting to give the true dash of local colour, here we have "stuffs, embroideries, and tapestries, twenty pieces." Our limits bid us hold our hand and brush over, scarcely touching, the swarm of minor branches of art that sue for notice. Here a quaint but tender old picture by Carlo Crivelli, signed and dated 1481, and there a sterner one by Gian Bellini, catch the eye; and again an enamel portrait by that brave artist Leonard Limousin, and worthy "Valet du Roi François Premier," of Tiercelin Laroche du Maine, "Chancelier de France," plaques by the Penicauds, and vases and salts in the graceful *grisaille* of Rexmon and Courtois, make one linger. In fine, the only answer to be given to the question, "What is the Soulage collection?" is that it is a very noble one, and one well worthy ot the deep study of all who would see our national art manufactures placed on a footing of equality with those of our honoured allies, the French.

LIMERICK LACE.

(From the *Limerick Observer*.)

All our readers are aware of the world-wide fame which the exquisite fabric known as "Limerick Lace" has acquired—of its celebrity as a bridal robe, or a ball-room costume in the highest and most fashionable circles; but as very few know the history of its introduction as a staple manufacture in our city, and one which has rendered incalculable benefits, both in a social and moral point of view, to the large number of young females, the children of the operatives, and especially of the labouring classes of Limerick, it may not be out of place here to advert briefly to its origin, progress, and present position.

The late Charles Walker, Esq., the founder of the establishment, was a native of Oxford, and was educated within the walls of its ancient University, with a view to his entering the church; but his disposition not being suited to the clerical office, and having a strong taste for science and art, he was apprenticed to an engraver and copperplate printer in his native city, a knowledge of whose business he rapidly acquired, and displayed a freedom and richness of style in many of his ornamental designs which at once stamped him as a master of his art. At the expiration of his apprenticeship he went to London, and there made the acquaintance of a family, one of whose daughters, a widow lady, was the owner of an extensive lace factory at Marden Ash, in Essex. This lady Mr. Walker married, and applied himself with great assiduity to the management of the establishment. His refined taste and skill, and his studied regard to correct execution of minute details, were brought to bear in the advancement of the style and finish of the lace work at Marden Ash, and soon obtained for it a preference in the markets.

But the exercise of the genius of Charles Walker was cramped within no narrow centre; it was expansive, and he sought a wider field for calling it into action. He came over to Ireland, and having visited Dublin, Belfast, Cork, and Limerick, he fixed upon Limerick as the scene of his future operations. And here we should not omit to make honourable mention of one whose early acquaintance and intimacy with Mr. Walker on the occasion of his first visit was mainly instrumental in securing for Limerick the advantages it has enjoyed for nearly thirty years by the introduction of the lace manufacture—we allude to James Morgan, Esq., now of Cork, but at that time a highly respectable citizen of Limerick, whose untiring exertions were always directed to the advancement of every project which could tend to raise our city in the social scale, and to promote enterprise and industry wherever a field could be opened for them.

To the inquiring mind of the English capitalist, Mr. Morgan pointed out the facility with which the labour of young females could be obtained here, the comparatively cheap rate at which it could be had, and the readiness with which suitable premises could be obtained. Before Mr. Walker left he became tenant of the large building at Mount-Kennett, which afforded those essential requisites for a manufacturing establishment, namely, ample room, good light, and thorough ventilation.

On the 14th of August, 1829, the "Lace Factory" first opened its portals, and six young girls entered to learn the craft, who thus formed the *nucleus* of its rapidly developing extension and prosperity. We had the opportunity of a conversation a few days since in Mr M'Clure's factory (of which more anon) with the very first girl that ever became a Limerick lace worker, then Margaret Ryan, now the sedate and thrifty matron—"Mrs. Mack." To detail her experience and impressions of what the manufacture of lace has done for the children of the humbler classes in Limerick, would be to go far beyond the bound we propose to confine our present remarks within.

Of the writer's own knowledge, inasmuch as he happens to be somewhat acquainted with the progress of this movement, which commenced a new epoch in the development of the "industrial resources of Ireland," so far as Limerick was concerned, the opening of the factory during the first year was a source of continuous outlay without any recompensing profit to the spirited proprietor. The children had to be *taught* to work. This could not be done except by practising them on pieces of coarse, and frequently of fine lace, with the expenditure of cotton, thread, tackers, rollers, tambour needles, and the various *minutiæ* indispensible for instructing. All this practice work was of course thrown aside, being utterly worthless, though the services of two and twenty young women, skilled teachers in the art of lace embroidery, and four in muslin work, specially brought over from England and paid, boarded and lodged in the factory at Mr. Walker's cost, were employed in bringing the children to that amount of proficiency, which would enable them to do work entitling them to be paid for it. By slow degrees, but sure, the good work prospered; men of note and mark cherished and cheered it on, and that institution which, in its infancy opened with six industrial neophytes, stood forth in its transparent development twenty years after, illustrating the benefits of prosperous enterprise and industry, in the one case to the employer, in the other to the employed. As the girls advanced in proficiency their earnings increased, and the addition which these earnings produced to the income of the working man made more popular and acceptable the new and beneficial employment thus created. Confidence became more extended when it was known that one of the most honoured members of his most honourable and benevolent profession in Limerick or in Ireland (we trust he will pardon this introduction of his name) Dr. William Geary, was the intimate friend of Mr. Walker, and one of the most influential patrons of the establishment.

The girls began to earn respectable wages as soon as they had acquired a competent knowlege of the work; three shillings and sixpence per week was about the average sum they could draw; and as they progressed it amounted to five, six, seven, or eight shillings a week, in many instances equalling, and in some instances exceeding the earnings of the head of the family.

It is well known that in Limerick, labouring men who have profitable employment during a portion of the year, while the provision trade, in curing beef, pork, &c., and in the corn trade, are suspended, remain for a part of the season wholly unemployed; and very many instances have come under our own observation where the wages of the factory girls sustained the family decently, and kept father, mother and children independent of the degrading, though otherwise inevitable medium of pauper relief in the Workhouse. We have not space to adduce many touching instances, but it is a matter beyond question that the extensive employment thus afforded kept together in comfort and hopefulness many happy though humble homes which, but for it, would be in all likelihood cheerless and desolate, and preserved perhaps from moral abandonment the child of many a pure hearted, religious and industrious parent.

Out of Mr. Walker's parent institution sprung many branches, which still continue in prosperous existence. Of these, the establishment carried on by Mr. M'Clure, in Clare-street, is the most extensive, and may be properly set down as the direct successor of the factory, originally commenced by Mr. Walker, with which Mr. M'Clure was connected as manager, for nearly twenty years before Mr. Walker's death. We were recently afforded the opportunity of visiting and inspecting minutely every department of it. It comprises three houses, Nos. 17, 18 and 19, Clare-street, all thrown into one, with direct communication on every floor each with the other. Here were five hundred and fifty young women and girls plying their busy industry, and producing as exquisitely finished work in many branches of lace embroidery as could be shewn from the manufactories of Brussels, Lyons, or Valenciennes. While looking over the rich and delicate fabrics in many of the frames, we recollected an observation made many years ago by Mr. Walker, that "he found the young girls of Limerick to possess a more ready acquirement of doing lace-work correctly and tastefully than in any other part of Europe that he had seen it carried on; and that they could be taught to acquire a perfect knowledge of it in half the time it would take to teach an English girl." From every stage of the process, when the plain net is given out, to its being finished for exportation, all was admirably complete; and in the wareroom where the goods are kept in stock, we saw some magnificent dresses, evincing remarkable taste and richness in design, and great beauty and perfection in the delicate elaboration of their workmanship. Among some of the most beautiful articles in lace which were shown us were a profusion of lace jackets, now the most fashionable article of ladies' attire in the highest circles. And there were veils and shawls, and sleeves and scarfs, and handkerchiefs, and the endless variety of articles which are indispensable to a lady's wardrobe—all got up with a skill, taste, and perfection for the cultivation and encouragement of which we sincerely trust the spirited proprietor may meet with encouraging support and ample reward.

ART TREASURES EXHIBITION.

On Wednesday last, Mr. Thomas Fairbairn (chairman) and Mr. Samuel Ashton, of the executive committee, with Mr. George Scharf, the art secretary, had the honour of a lengthened interview with His Royal Highness Prince Albert, at Windsor Castle. A list of the works already obtained was submitted to his Royal Highness; who, after examining it, suggested that certain pictures from the royal collection would be very useful as enabling more complete classification to be effected, and promised that they should be included in the Royal contribution.

The Royal Society of London have authorised the committee to make a selection from their well known gallery of portraits of men distinguished in art and science.

The Committee of the Liverpool Royal Institution have placed the Society's pictures and drawings unreservedly at the disposal of the executive committee.

Home Correspondence.

BESSEMER IRON.

Sir,—No practical man, with a grain of common sense, would have expected Bessemer's process to be capable of producing forged iron by casting ingots, as Mr. Gladstone would seem to insinuate in his letter on this subject, inserted in your last number. Cast-wrought, or cast-forged iron, is a solecism in deed as well as in language, but still the fact that Mr. Bessemer has produced puddle iron fit for the rolls or the hammer without the usual puddling process, and without fuel, is clear and undoubted, and quite sufficient therefore to place that gentleman's name in the list of first-class inventors.

It has never been proposed to cast a first-rate anchor from Bessemer ingots, but merely to produce a pure iron, fit for such purposes, by simple and inexpensive means, which would have to go through the rolls, or under the hammer before actual use, like all other puddled iron. Forging or rolling produces a change in the arrangement of the particles which will perhaps ever evade the searching power of chemistry, that is to say, two masses of iron may appear to the chemist identical, but if one be forged and the other cast, there will be a vast difference between them mechanically speaking.

The general tone of Mr. Gladstone's letter is precisely that of the trade; all persons associated with trade and commerce, appear to have a deep-rooted antipathy to all change, down to the mere workman and labourer. When the duty was abolished in the glass trade, did not both workmen and masters combine to defeat the beneficial effect of that measure in regard to the consumers, and would they not have continued to do so had it not been for foreign importations? There will be, as usual, a combination against the Bessemer process, which may be termed a species of fraud upon the consumers, against whose pecuniary interests everlasting war is waged, as a matter of course, by all who are connected with trade.

The Bessemer process is very simple and economical, can be most effectually tested, almost in a few hours, in every foundry and iron mill, and it would have been, therefore, much more reasonable, as well as in better taste, to have caused such trials to be made instead of attempting to write it down. But Mr. Bessemer has an exclusive right, and therein lies all the mischief.

Why did not Mr. Gladstone induce his friends, the iron masters, to make some trial of the process at their large iron works, which would have cost nothing, comparatively speaking, either in time, trouble, or expense, instead of requiring Mr. Bessemer to produce hundreds of tons at his own ruinous cost? No, the ironmasters, like all other tradesmen, will lend themselves to no change in the mode of conducting their operations, until compelled to do so by public opinion, or until the projector shall have been ruined, and his process fraudulently transferred to the public, as was the case with the talented, but unfortunate, Henry Cort.

A perfect sample of cast wrought-iron—I use the phrase though I disapprove of it—was produced by Mr. Fielding, as you may remember, long before Mr. Bessemer's process was publicly known, but the ironmasters set their faces against any such innovation, and decreed most superficially that it was useless, and was besides rendered unnecessary by processes previously known to the trade.

I am, &c.,

HENRY W. REVELEY.

Parkstone, Poole, Dorset, Nov. 3rd, 1856.

BESSEMER IRON.

Sir,—Much has been done in regard to iron, yet we have much to learn respecting it; especially as to different modes of its manufacture, so as to ensure its strength. Sir Samuel Bentham, at an early part of this century, ascertained that "The great superiority of strength which may be given to metals by hammering or rolling, has been ascertained beyond a doubt—that the best Swedes iron may, by hammering, be increased about a seventh in strength—that though the best Swedes iron so hardened, broke with seven tons and a-half, English copper rolled sustained six tons before it broke; and, what is very important, that one of the mixtures of metal used in the metal mills, bore a weight of five ton seven cwt. and a half before it broke."* But this does not appear to hold good when large masses of the metal are operated upon. Hence, it has been found, that anchors, when hammered, became hard and tough as steel on the surface, but granulated like cast-iron within. Mr. Nasmyth failed in his manufacture of a large piece of ordnance, though the hammer used by him was proportionably heavy, its strokes being heard at a distance of half-a-mile. Another piece of ordnance, since manufactured, was found to have its interior as soft as plumbago. It is one of a smaller bore that has lately been found efficacious, as I learn from an eye-witness—hence the old method of making large guns has been resorted to—namely, that of connecting small bars together by hoops. The portion of Bessemer's iron, noticed in the *Journal of the Society of Arts*, which proved so strong, was rolled, thus confirming the idea that crystallisation was destroyed by rolling. Sir Charles Trevelyan proposed in your pages that iron should, like wood, be as it were laminated, though this might not be expedient, for the reasons he stated, yet on other accounts it seems advisable.

The conclusion to be deduced from the above is, that further experiments are needed for ascertaining the most desirable process for manufacturing iron in large masses.

I am, &c., M. S. BENTHAM.

26, Wilton-place, Nov. 3rd.

Proceedings of Institutions.

Bucks and Berks.—The Bucks and Berks Lecturers' Association, desirous of encouraging to the utmost of its power, adult education, offers to the Institutes, reading and class rooms in union with it, the following inducements to persevere in the formation and maintenance of evening classes. A gratuity of £2 to the Institute or reading room with the greatest number of pupils for classes, (in proportion to the number of its members,) during the season of 1856 and 1857. A gratuity of £2 to the class whose members, during the same time, have been most regular in their attendance. No pupil to be counted, who has attended less than four times a month, or who is not engaged in earning his livelihood. A present of books to the value of £1 to the pupil who has attended his class with the greatest regularity. A public examination in Mathematics, Geography, History, English Language, and Literature, will be held in Windsor, in the spring of 1857, for members of Institutes, Reading, or Class Rooms, in union with the association, when prizes will be awarded, of the respective values of £3, £2, and £1, accompanied by the certificate of merit of the association. If successful candidates intend afterwards offering themselves for the examination of the Society of Arts, the prizes will be given them in money, (should they desire it,) to help to defray their expenses. Prizes, to the value of ten shillings each, will be given for the best executed map of Europe, and the best plan of a locomotive steam-engine.

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* Statement of Services, page 171.

MANCHESTER.—The Right Hon. Sir John Pakington has consented to address the members of the Manchester Athenæum, on the 18th inst., on the subject of national education.

PORTSMOUTH AND PORTSEA.—The recently published report of the Literary and Philosophical Society states, that during the past year there has been a considerable increase in the number of members; but, notwithstanding this, the attendance in the lecture-room has not exceeded the usual average; the experience of each successive year strengthens the conviction that with the system of desultory lectures the public mind has ceased to sympathise. The weekly lectures have rendered essential service by diffusing information and awakening inquiry; but they have not proved sufficiently effective as the basis of Adult Education: the results have not been proportional to the capabilities of the machinery in action; the work has been superficially executed; the Society, in order to preserve that degree of respect to which its designation entitles it, must direct its most strenuous exertions to increase the proportion of members who are able to appreciate a truly scientific discussion. The committee feeling the necessity for the introduction of some change in the proceedings, submitted to a general meeting a proposition, the practical effect of which was to confer on the committee of management authority to admit non-members to special courses of lectures on the payment of a specified fee; this proposition was unanimously adopted. During the past year the Society of Arts has organised a system of examinations for the students in classes connected with the Institutions in Union. This important movement has been termed the great event of the session, and it is destined to exert a healthful and invigorating influence upon the proceedings of the associated Institutions. The committee earnestly recommend the Society to consider the practicability of so far extending its operations as to admit a class of students who may desire to become candidates for the examinations, and to compete for the prizes. Since the last anniversary the Society has entered into union with the Hants and Wilts Adult Educational Society, and has thereby become entitled to the privilege of selection from their published list of gratuitous lectures, and to the free use of the diagrams and apparatus in the possession of the Educational Society. An Exhibition of Works of Art was held in the Museum, and nearly 150 valuable oil paintings, thirteen water colour copies of pictures in the Queen's collection, four stereoscopes with a great variety of slides, several interesting figures and statuettes in bronze, Parian, and terra-cotta were exhibited. The opening soirée was held on Friday, June the 27th, on which occasion Dr. Engledue delivered a lecture on the Oxy-hydrogen Microscope; several soirées have been subsequently held, a lecture on Philosophical Experiments, illustrating some branch of science, usually forming a part of the arrangements. 857 tickets were issued for the various soirées; 557 for the inspection of the pictures; the general total being 1414.

ROYSTON.—On Wednesday, 29th October, a lecture on New Zealand was delivered at the Institute by T. S. Forsaith, Esq., late Member of the House of Representatives. The lecturer related the story of his life in New Zealand, commencing with his first journey on that land. He gave a brief historical sketch of the past, and took a survey of the present condition of these islands. Mr. Forsaith having resided nearly twenty years in New Zealand, his observations were the result of great experience. He is about to return to his home at Auckland, in the land of his adoption. The lecture was made more interesting through the exhibition of some beautiful coloured sketches, of large size, showing, among others, "The Settler's First Home" and "The Settler's Present Home." The lecture gave great satisfaction to a large audience.

WINDSOR AND ETON.—The third lecture of the present session was delivered on Wednesday, October 15th, at the Literary, Scientific, and Mechanics' Institution, by the Rev. G. G. P. Glossop, M.A. The subject was Printing, chiefly with relation to the anastatic process. The chair was taken by the Rev. W. C. Bromehead. A large number of members, with their friends, mustered, and well filled the hall. The rev. lecturer began by giving a definition of printing, which, he said, consisted of the production of copies of a certain object by means of a surface in relief, ink, and pressure. The so-called photographic printing, as at present performed, cannot really be said to be printing, as light is the means employed for taking copies. It is supposed that the first idea of printing is coeval with the building of Babylon, many bricks found in its supposed site being printed or impressed. The Romans may be said to have been printers, articles of their manufacture being found with brands on them, in the same way that spades and tools are branded now. Printing from blocks cut in relief is supposed to have been first practised in China, 50 years before Christ, and the same method is employed there at the present day. The first application of printing in Europe seems to have been for the production of religious prints and playing cards, and the first important step in the art was the employment of small blocks and moveable type, instead of the whole page blocks. Another improvement was the introduction of line engraving in taking maps, copies of pictures, &c. This derived its origin from the plan of the goldsmiths and jewellers of the middle ages, who, in order to see how their designs looked while being chased out, filled the cut away surface with ink, and then obtained a reversed fac-simile of the work on paper. The lecturer then proceeded to show what printing had done for mankind during the 400 years it had been in use—the increase of religion, spread of knowledge, the dissipation of error, the comforts of life, in the arts of peace, trade, even in those of war, in the production of books and music, in the pictorial, decorative, and manufacturing arts. The anastatic process was then fully described, and the patentee, who was present with his apparatus, proceeded, by way of illustration, to print off several copies from a wood-cut in *Punch*, which were afterwards distributed among the ladies present. The numerous uses of this process, its many advantages over other methods, its accuracy, applicability, and cheapness were dwelt upon. The evil attending this, like other benefits, namely, the facility it offers for committing forgeries, was alluded to, and the patentee described a plan by which paper could be so prepared that it should be impossible to take copies of bank notes, cheques, and other important papers. Various other kinds of printing were then referred to, the methods employed described, and the advantages or disadvantages attending each dwelt upon. Typography, or common printing, being so well known, was only alluded to. Copper and steel plate engraving, etching, wood engraving or cutting, stereotypes from wood blocks, lithography, chromo-lithograpy, or printing in colours, and nature printing, were all fully described, and a plan now in course of being carried out for actual printing from photographic plates, was alluded to. The lecture was very interesting and instructive, and the exhibition of the anastatic press and process, a large number of engravings, plain and tinted lithographs, specimens of nature printing, &c., added much to its attractiveness.

Yarmouth.—The annual meeting of the Parochial Library and Museum, was held in the Priory Library, on the 24th ult. There was a large attendance of members. The Rev. G. Hills, B.D., in the chair. The Chairman observed that they were met together, in accordance with annual custom, at the anniversary of the Parochial Library and Museum, and he believed they would say, when they heard the report, that they had met under circumstances more favourable than at any period since the formation of the society. They were all aware that there were certain great objects for which the Institution was founded, and their endeavour would be to keep those objects in view, and carry them out to their accomplishment. They lived in an age of great educational progress, and one of the circumstances that marked that progress was the facilities afforded for self-improvement and pleasure from knowledge; and that Institution was a part of the great educational progress that was being carried forward, and they endeavoured there to take their part in the great movement which characterised the age. But they not only wished to join in that educational progress, but they desired as well to connect it with that which was pure, and lovely, and true, and hence it was that they took care not to allow it to sink down into pursuits of a lower taste. They, no doubt, at times felt that some of the subjects were dry, and others tedious, but they should continually remind themselves that in such work there must necessarily be a certain amount of what was dry, and that they must go through the drudgery to reap the fruits and pleasures of knowledge; and every man who desired to excel, no matter whether it was in business, or knowledge, or science, must expect to experience a certain amount of toil, anxiety, and labour; and that was the argument by which he would meet the objections that were made to institutions of this kind, that the lectures were not always of an amusing character. They had endeavoured to combine all that was really useful with much that was instructive and amusing, and when they looked back upon the attendances at their lectures during the past year, and the money that had flown into their exchequer, it would prove that they had met the tastes of a large part of the community. He would also urge upon those young persons who were present not to be led away by what was light, to the exclusion of that which was of more solid worth. He considered that at the present day even some of the dry work was made much pleasanter than it used to be. It often struck him that school must be a much pleasanter place than it used to be. He could hear shouts of laughter and all sorts of fun sometimes an hour before school began, and he looked out and saw things looking almost like monkies, climbing up the gymnastic poles, and he found they were boys who had come before the school commenced. At one time, according to the poet, it used to be—

> The whining school-boy with his satchel,
> And shining morning face, creeping, like snail,
> Unwillingly to school.

And if their schools, under such excellent teachers as Mr. Hewke, Mr. Brand, and Mr. Harding, were such happy places, that Institution, in carrying out the higher branches in their college, so to speak, for really they were approaching the dimensions of a college, endeavoured to combine recreation with that which was solid and useful. It had, therefore, been arranged that in the present session they should have musical evenings, under the direction of Mr. Stonex, and from that they would derive pleasure; for they were to remember that the poet also said,—

> The man that hath no music in his soul,
> That is not moved with concord of sweet sounds,
> Is fit for treasons, stratagems, and spoils;
> The motions of his spirit are dull as night,
> And his affections dark as Erebus:
> Let no such man be trusted.

They kept those two objects in view: to promote the improvement of the mind, and to make it as cheerful and happy as they could. They would hear from the report that, during the past year, their efforts had been successful, and he doubted not that, with the blessing of God, they would still go on increasing in usefulness. The rev. gentleman concluded by calling on the hon. secretary to read the report. The Rev. F. W. Johnson read the report, from which it appeared that the number of members in 1855 was 255; and in 1856, 320. Many standard works had been added to the Library. The reading-room had been well attended. The attendance at the lectures had been more numerous than in former years. The Library at present contains 2,628 volumes, being an increase of 202 volumes since October, 1855. The number of volumes issued to subscribers had been 5,900, and with the book club circulation of 4,680 volumes, gave a total issue of 10,580 books, besides the books that were used every evening in the Reading-room. The committee looked to the classes lately opened as a powerful means of improving the young members of the institution, and fitting them for situations under government, or in large commercial firms. During the winter months, free instruction was given as usual in reading, writing, and arithmetic, to 100 male adults, and considerable improvement was visible. The Militia schools were conducted at the same time and under the same superintendence as the evening classes. The French class numbered 22 pupils, and was being continued under the superintendence of Mons. Vincent. The anniversary of the institution was celebrated by a literary and scientific entertainment, at which 1,500 tickets were issued. Mr. R. H. Palgrave (in the absence of Mr. T. Brightwen) read the financial statement, from which it appeared that the finances of the Society were also in a flourishing state, the total income being £213 17s. 8d. The expenditure had been £163 11s. 7d., leaving a balance in hand of £50 6s. 1d. The Rev. G. F. Slade moved that the report and financial statement be adopted and printed for circulation amongst the members. Mr. W. S. Johnson seconded the resolution, which was carried unanimously. The following gentlemen were elected on the Committee:—Mr. Morant, Mr. E. R. Aldred, Mr. Steward, and Mr. Stonex. Mr. Goodwin said, he had hoped that some suggestion would have emanated from the Society, with the view of calling the attention of the tradesmen and the public to the desirability of closing the shops earlier of an evening. He himself, with many others, was prevented attending the classes, by the system of keeping open the shops late in the evening. The Chairman remarked that he had taken much interest in the subject; he had given a lecture, and set forth in the best way he could, the desirability of early closing. He should be glad to see that Institution take up the subject with the view of settling the question, and to carry it out in a manner that would be satisfactory to both employers and employed. Lowestoft and Lynn, and other towns near them, had agreed to close at seven o'clock, and he hoped they would do so in Yarmouth. After some discussion as to the best mode to be adopted to carry out the object in view, Mr. Lupson moved, and Mr. Harding seconded, "That this meeting deeply deplores the system of late hours in trade, feeling it to be injurious to the health, the mental and social good of the young persons engaged in it."—Carried. Mr. Goodwin moved, and Mr. Mann seconded, "That a committee be formed for the purpose of carrying out the foregoing resolution, and of waiting upon the different tradesmen with the view of obtaining the closing of shops at seven o'clock, on and after the 3rd of November."—Carried. Mr. Laws moved a vote of thanks to the Rev. F.W. Johnson, the honorary secretary, which was seconded by Mr. M. J. Pratt, and carried unanimously. The Rev. F.W. Johnson acknowledged the compliment, and observed that in conjunction with the other honorary secretary, Mr. R. H. Horner, they would continue to do their best for the interests of the Institution. Mr. Hewke moved a vote of thanks to the chairman, which was carried by acclamation, and the meeting broke up. Classes have been opened on the following subjects, and some of them are very numerously attended:—Church History of England; English History and Constitution; English Literature and Composition, and Writing from Dictation; Roman History and Latin; Navigation; Mathematics and Book Keeping; Short-hand; French; Vocal Music (Hullah system).

MEETINGS FOR THE ENSUING WEEK.

Mon. Geographical, 8½. I. "Proceedings of the North Australian Expedition, under Mr. A. G. Gregory." II. Mr. A. R. Wallace, "Notes of a Journey up the Sadong River, Borneo." III. Lieut. De Crespigny, "Proposed Exploration of Borneo."

Tues. Syro Egyptian, 7½. Mr. Bonomi, "On the Metaphorical Sculptures of Egypt."
Civil Engineers, 8.
Zoological, 9.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October* 31*st*, 1856.]

Dated 3rd September, 1856.

2046. Jean Baptiste Marcelin Jobard, Directeur du Musée de l'Industrie Belge a Bruxelles—Improvements in the manufacture of lamps.

Dated 17*th September*, 1856.

2178. Alfred Lodwick Newman, New Church-street, Bermondsey—Improvements in processes for separating animal from vegetable fibre, and for adapting the products to manufacturing purposes, and in the machinery employed therein.

Dated 19*th September*, 1856.

2199. Amos Hustler, Bradford—Improvements in looms for weaving.

Dated 27*th September*, 1856.

2265. David Law and John Inglis, Glasgow—Improvements in moulding or shaping metals.

Dated 2nd October, 1856.

2313. Michael Thomas Crofton, Leeds—An apparatus for indicating and registering the number of persons entering a public vehicle or carriage.

Dated 3rd October, 1856.

2316. John Hall, jun., Mount Pleasant, Walmersley, near Bury, Lancashire—Improvements in looms.

Dated 6th October, 1856.

2333. John Gedge, 4, Wellington-street South, Strand—Improvements in the preparation of rocky substances for obtaining mineral manure. (A communication.)

2335. Andrew Dunlop, Glasgow—Improvements in dressing or sifting flour or meal.

2337. Victor Avril, Paris—Improvements in the manufacture of iron and steel, and in the construction of furnaces to be employed therein, also in the obtaining of a certain agent employed in such manufacture.

Dated 7th October, 1856.

2339. Thomas Briggs Smith, Taunton, Massachusetts—Improvements in the permanent way of railways, and in the running of railway carriages.

2341. William Nehemiah Parsson, Southwark-bridge-road—An improved construction of rotary sawing machine.

2343. James Hinks, Birmingham—A new or improved manufacture of metal boxes.

2345. William Wilkinson, Nottingham—Improvements in ornamenting glass, and in the preparation of the materials employed therein.

2347. Jules Adolphe Le Franc, Cecil-street, Strand—An improvement in lubricating oil cans or vessels. (A communication.)

2349. William Marriott and David Sugden, Huddersfield—An improvement in purifying coal gas.

Dated 8th October, 1856.

2351. James Chiosso, Camden-town—An apparatus for damping and affixing adhesive stamps and labels.

2353. Edmund Alfred Pontifex, Shoe-lane, and George Henry Ogston, Greenwich—Improvements in the manufacture of tartaric and citric acids.

2355. John Leigh, Manchester—The use or application of a certain substance or substances in the manufacture of paper for stiffening and sizing the same.

2357. Thomas Dugdale, jun., Blackburn, Lancashire—An improved lubricator.

2359. Peter Ward, Liverpool—An improved composition for coating the bottoms of ships.

2361. Charles Iles, Birmingham—Improvements in frames and stands, and in suspendors, or pegs for holding or suspending hats, coats, and other articles.

Dated 9th Ortober, 1856.

2365. James Atkinson Longridge, Fludyer-street, Westminster, and Thomas Richardson, Newcastle-upon-Tyne—An improvement in constructing the fire boxes of locomotive steam boilers.

2367. Charles Burton, Regent-street—Improvements in machinery for washing and cleansing fabrics and clothes.

2369. Joseph Bennett Howell, Sheffield—Improvements in the manufacture of cast-steel.

2371. Lewis Jacob Jordan, Berners-street—A medicine for the cure of venereal affections.

Dated 10*th October*, 1856.

2373. Jean Alexandre Labat, junr., Bordeaux—Improvements in closing or stoppering bottles, jars, and other like vessels.

2375. Christopher Richard Norris Palmer, Southampton—A signalizing apparatus for carriages, and improved telegraph or signal apparatus, applicable to other purposes.

2377. William Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of fulminating powder. (A communication.)

2379. John McInnes, Liverpool—An improved surface mineral coating for protecting iron and other substances, and an improved vehicle or varnish by which it is applied, and which varnish may be used with or without the addition of other substances.

2381. Robert McConnell and Alexander Mackenzie, Glasgow—Improvements in supplying steam boilers with water, part of which improvements or modifications thereof are applicable for the transmission of fluids and the indication of fluid levels under pressure.

Dated 11*th October*, 1856.

2383. William Hindle Ashburn and James Fairhurst, Blackburn—Improvements in machinery or apparatus used in the preparation of cotton or other fibrous substances for spinning.

2387. James Latham, Liverpool—Registering the number of passengers by omnibuses and other vehicles and conveyances.

2389. George William Varnell, Royal Veterinary College, Camden-town—Improvements in mounting troughs, mangers, and apparatus used for feeding horses and other animals.

2391. Léopold Ador, and Edouard Abbadie, Paris—Improvements in the manufacture of colours from metals, and in the furnaces or apparatus for the same.

Dated 13*th October*, 1856.

2393. Charles Sidney Johns, Barnard's-inn, Holborn—Improvements in machinery or apparatus for preparing pulp suitable for the manufacture of paper.

2395. Benjamin Kisch, Kennington—An apparatus for containing an arrangement of cards or papers for selection. (A communication.)

2397. Giovanni Battista Piatti, Genoa—Improvements in the production of ice.

2399. John Stephen, Glasgow—Improvements in steam boilers and furnaces.

Dated 14*th October*, 1856.

2403. Richard Archibald Brooman, 166, Fleet-street—An improved method of, and composition for, splitting or rending rock, stone, and earth. (A communication.)

2405. Thomas Allen, Clifton—An improvement in the manufacture of iron and other metallic bedsteads.

Dated 15*th October*, 1856.

2409. James Burrows, Wigan, Lancashire—An improved arrangement of apparatus employed in winding coals or other minerals from mines, which said improvement is also applicable for other similar purposes.

2411. Archibald Turner and Luke Turner, Leicester—An improved manufacture of elastic fabrics.

2413. George Hazeldine, Lant-street, Southwark—Improvements in carriages requiring 'poles' between the horses or draught animals.

Dated 16*th October*, 1856.

2414. George Collier, Halifax—Improvements in the manufacture of piled fabrics.

2415. Alfred Tooth, 14, Mincing-lane—An improved process for bleaching malt, whereby the colour is rendered more suitable for the brewing of pale or bright malt liquors.

2416. Carl Johan Laurentz Leffler, Old Broad-street—Improved apparatus for the casting of metals.

2417. Richard Ford Sturges, Birmingham—A new or improved manufacture of rollers or cylinders for printing fabrics.

Dated October 17*th*, 1856.

2418. Charles Napoleon Wilcox, Islington—Improvements in the preparation and application of certain vegetable matters to be used in toilette soaps, pomades, and other like perfumery.

2419. Edward Tombs, Islington—An improvement in screw propelling.

2420. Joseph Commandeur, Lyons—A mechanical apparatus for regenerating the impulsive force of any motive power.

2421. Ferdinando Foggi, 24, Southampton-place, New-road—Improvements in the manufacture of engines driven by steam or other vapour.

2422. John Green, 27, Charlotte-street, Portland-place, Marylebone—An improved cooking apparatus.
2423. Ebenezer Rogers, Abercarn, Monmouthshire—Improvements in apparatus for the decomposition and combustion of fuel.
2424. Jane Elizabeth Reed, Southgate, Middlesex—A mixture or compound for the cure of asthma, consumption, and other affections of the chest or lungs.
2425. Peter Armand le Comte de Fontaine-moreau, 39, Rue de l'Echiquier, Paris—Certain improvements in the construction of turbines. (A communication.)
2426. Peter Armand le Comte de Fontaine-moreau, 39, Rue de l'Echiquier, Paris—An improved process for purifying brandies and other alcoholic products. (A communication.)
2427. William Dray, Swan-lane—An improved method of and apparatuses to be employed in the stacking or storing of corn and other agricultural and horticultural produce.
2429. William Jeffrey, Glasgow, N.B.—Improvements in machinery or apparatus for sawing or cutting wood.
2430. John McDowall, Johnstone, Renfrewshire—Improvements in sawing or cutting wood.
2431. Napoleon Brécheux, Paris—Improvements in looking-glasses applicable especially for dressing rooms and for other purposes.
2432. George Morton, Keighly, Yorkshire—Improvements in escapements for chronometers and other time-keepers.
2433. Thomas Frederick Henley, Bromley — The employment of certain substances not hitherto made use of, for the production of alcoholic spirits, and for the manufacturing of the same, the refuse material being applicable as a food for cattle.
2434. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the manufacture of tufted pile fabrics. (A communication.)
2435. William Gossage, Widness, Lancashire—Improvements in the manufacture of coal-gas used for illuminating purposes.
2436. John Smith, Kirtley, Suffolk—Improvements in heating the feed-water of steam boilers for marine and land purposes.
2437. Samuel Cunliffe Lister and William Tongue, Bradford, Yorkshire—Improvements in spinning.
2438. James Robert France, Clarence-street, Islington—Improvements in electric telegraph apparatus
1439. Frederick Arthur Magnay, Taverham Mills, near Norwich, and Ralph Radcliffe Whitehead, Royal George Mills, Saddleworth—Improvements in damping paper for printing.
2440. William Palmer, jun., Sutton-street, Clerkenwell—Improvements in roof candle-lamps for railway and other carriages.
2441. Thomas Lawes, 32, City-road—An improved construction of agricultural implement to be used in tilling the land.

Dated October 18th, 1856.

2442. Robert Hanham Collyer, M.D., 3, Park-road, Regent's-park—Improved method of manufacturing paper.
2443. Leon Joseph Pomme de Mirimonde, Paris—Certain improvements in reducing the friction of axles and axeltrees of carriages on railways.
2444. Isidore Delcambre, Paris—Improvements in machines for composing and distributing type.
2445. Joseph George, 39, Rue de l'Echiquier, Paris—An improved crane.
2446. Jacques Felix Deshayes, Paris—Improvements in machinery for dyeing silk, cotton, or wool in hanks or skeins, or woven fabrics.
2447. Henry Brown, Halifax—An improvement in spinning worsted.
2448. Thomas Flockton, 4, Trafalgar-square, Charing-cross—Improvements in the consumption of smoke.
2449. Charles Humfrey, 14, The Terrace, Camberwell—Improvements in the manufacture of grease for lubricating railway axles and other machinery.

Dated October 20th, 1856.

2450. Joseph Harrison, Blackburn, Lancashire—Improvements in machinery for warping yarns, parts of which improvements are applicable to creels used for other purposes.
2451. Sir Francis Charles Knowles, Bart., Lower Hill, Berkshire—Improvements in the manufacture of iron and steel, and in the preparation of fuel used therein.
2452. Richard Archibald Brooman, 166, Fleet-street—Improvements in farthingales or petticoats. (A communication.)
2453. Léon Philéas Huteau, 39, Rue de l'Echiquier, Paris—An improved petticoat.
2454. James Young, South Shields, Durham—An improved ventilator.
2456. Joseph Lacassagne and Rodolphe Thiers, Lyons—An improved electric lamp.
2457. John Thomas Forster, Wandsworth-road, Surrey—Improvements in the symbols used in signalling.
2458. Josiah George Jennings, Holland-street, Blackfriars—Improvements in the construction of wall caps, sleeper blocks for the basements of buildings, and bricks to be used as substitutes for wood bricks in building.
2460. Anthony Lorimer, Bedford-square East, Commercial-road—An improvement in reworking vulcanized india rubber.
2461. William Parsons, Pratt-street, Lambeth—Improvements in generating and employing steam in steam engines.
2462. Henry Deacon, Hans-place, Chelsea—Improvements in suspending carriage bodies.
2463. William Clay, Liverpool, and Josiah Harris, Dolgelly, Merionethshire—Improvements in the manufacture of iron and steel.

Dated October 21st, 1856.

2465. Henry Thompson, Great Harwood, near Blackburn, Lancashire, and Thomas Curtis, Blackburn—Improvements in the manufacture of healds or heddles.
2467. George Blair, Leicester—Improvements in the manufacture of looped fabrics.
2469. Spencer Smith, Soho—Certain improvements in furnaces.
2471. John Shaw, Britannia Iron Works, Neithrop, Banbury—Improvements in preparing the food of cattle.
2473. Edward Orange Wildman Whitehouse, London, and Joseph Christopher Laws, Brighton—Improvements in tools for soldering metals.
2475. Hugh Lee Pattinson, Scots' House, near West Boldon, Durham—Improvements in the treatment of certain salts and oxides of manganese.
2477. Alfred Vincent Newton, 66, Chancery-lane—An improvement applicable to the reefing, furling, and unfurling of sails. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

Sealed November 1st, 1856.

1042. William Naylor.
1054. Wright Garside.
1061. Amedée Louis Beudant and Jean Louis Marie Paul Benoit.
1062. Obed Blake.
1089. Alfred Vincent Newton.
1131. Henry Bragg.
1139. Gustavus Palmer Harding.
1155. Samuel Weston Moore.
1169. Alfred Vincent Newton.
1193. William Cardwell McBride.
1217. William Galloway and John Galloway.
1221. Wm. Churchill Dempsey.
1255. Charles Cowper.
1269. Frederick Peter Dimpfel.
1297. Henry Cartwright.
1338. John Betts.
1361. Alexander Robertson.
1381. Alfred Vincent Newton.
1563. John Pendlebury.
1634. Charles William Lancaster.
1685. Ebenezer Seymour.
1767. William Wood.
1899. Edward Hallen and William Holland Kingston.
1928. John Stopporton.
2011. Edward Poitiers.
2055. George Alfred Lewis.

Sealed November 4th, 1856.

1071. William Joseph Curtis.
1072. Ralph Heaton, jun., Harry Heaton, and Geo. Heaton.
1079. Alexander Ebenezer Riddle and Isaac Hoare Boyd.
1090. Stephen Walter Underhill.
1095. Ferdinand Potts and Thomas Vann.
1117. Edouard Besnier de la Pontonerie.
1132. William Galloway and John Galloway.
1133. Hiram Groves.
1143. William Crofts.
1160. Joseph Martin.
1180. Jeremiah Brown.
1194. Alfred Vincent Newton.
1197. Joseph Henry Beynell de Castro.
1207. George Heron.
1230. Samuel Berrisford and Enoch Wilkinson.
1242. John de Cockkenifeck.
1248. Frederick Peter Dimpfel.
1286. Francis Alton Calvert.
1287. Alfred Watson and Alfred Hamlyn Williams.
1336. William Smith.
1730. Samuel Colman.
1744. William Webster.
1809. William Edward Newton.
1875. William Webster.
1906. John Goddard and George Hulme.
1946. Charles Clark.
1989. James Earl of Caithness.
2070. Robert Wilson.
2117. William Webster.
2119. William Oldham.

Patents on which the Third Year's Stamp Duty has been Paid

October 28th.

2573. Charles Carr and William Kyle Horsley.
2591. Humphrey Chamberlain.

October 29th.

2521. John Crowley.
2545. Richard Edward Hodges.
2552. Bryan Edward Duppa.

October 30th.

2508. Joseph Haley.
2514. George Hamilton.
2515. Anthony Park Coubrough.
2528. James Chesterman.

October 31st.

2524. Mark Newton.
2543. Henry Brierly.
2549. John Moffat.

November 1st.

2578. Edwin Kesterton.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3895	Oct. 30.	Improved Weft Fork	James and Eli Gleave	Stockport.
3896	„ 31.	Improved Turnip Cutter	G. Wood and Son	Chelmsford.
3897	„ —.	Lever Table Catch	Cope and Collinson	Birmingham and Oxford.
3898	Nov. 3.	Improved Water Closet	John Walker	Doncaster.
3899	„ 4.	Safety Pocket Protector	Thomas Octavius Jones and Stopford Jones	33, Newgate-street, City.
3900	„ —.	Bracelet and Necklet Fastening	William Russ	27, Gloucester-street, Clerkenwell.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 14, 1856.

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MEETING OF COUNCIL.

Nov. 12th, 1856.

The Council have determined to appropriate, for the convenience of members, the three lower rooms in the Society's House, hitherto occupied as the Secretary's offices. These rooms will, on and after the commencement of the Session, be available for the use of members, as library and reading room, writing room, &c.

The following schools have been taken into union since the last announcement:—

Queenwood College, Stockbridge, Hants.
The Trade School, Wandsworth.

NOTICE TO MEMBERS.

A letter, announcing the opening of the Session, and enclosing tickets for the admission of members' friends, has been sent to each Member. Any Member not having received the notice and tickets, is requested to inform the Secretary.

APPROXIMATE SOLUTION OF EQUATIONS.

The gentleman who, in May last, anonymously sent £10 to the Society as a prize for this subject, is particularly requested to communicate with the Secretary.

ON IMPROVEMENTS IN MACHINERY AND IN MANUFACTURING PROCESSES, AS AFFECTING THE CONDITION OF THE LABOURERS.

The following is extracted from an address to a section of the recent Philanthropic Congress at Brussels, by Mr. Chadwick, containing statistical facts and observations made from his position as one of a Board of Commissioners for enquiring into labour in manufactories, more particularly on the bearing of improvements in machinery and manufacturing processes on the economical condition and means of labourers, and which was ordered to be printed in the *Moniteur*:—

"You may often see it alleged in Parliament, or in the course of public agitation, that the tendency of improvements in manufacturing machinery and processes, is to injure the labouring classes, and, as a proof, the reduced price paid to the artizan for the production of a given quantity of goods, is commonly put forth.

"The real tendency of manufacturing improvements, as respects the working classes, will, however, be best shown by the facts respecting the progress of Lancashire, our chief manufacturing county. The whole manufacturing tendency in that county, during the last half-century, and before it,—beginning with the displacement of the distaff and then of the spinning wheel—has been to displace hand-labour, by the use of labour-saving machines; yet the more labour that has been displaced by machinery, the more labour has been wanted. Within that half-century the entire population of the district has more than doubled. Some fabrics, which were consumed almost exclusively by the wealthier classes, were highly paid for in wages, as well as in profits to the manufacturers of them. In particular instances the wages have been reduced, under circumstances which have led to an extended production and consumption by the masses; but the real general progress of the chief manufactures, and of the wages of the entire district, may be illustrated by the following particular instance.

"A partner in one of the chief manufacturing firms in Lancashire wrote to me, as follows, in 1841:—'The same yarn which cost my father 12d. per lb. in 1792 to make—all by machinery—now costs only 2d. per lb. to make, paying then only 4s. 4d. per head as weekly wages, now 8s. 8d. per head, or more—yet those weekly wages amounted then to 5½d. per lb., and notwithstanding the increase they now amount to only 1d. per lb.' Since 1841, the entire cost of making the yarn has been reduced, and the cost of labour, per lb., has also been reduced; but the average weekly wages have advanced to 9s. per week, and more. The work people, amongst whom these wages are divided, consist chiefly of women and children, not one-fourth of the hands being adult males. Where three members of a family are engaged, the father, mother, and one child, the aggregate wages will now be 27s. per week, or more; that is to say for spinning; but weaving, as well as spinning, is carried on in the same manufactory, and the average wages paid for weaving alone, principally done by young women, are 11s., and, including overlookers and all the processes, the average wages of the working people are 13s. a week: that is to say, an average family of three in employment would earn 39s. as weekly wages.

"And, on examining the progress of the manufacture, there appear to be elements ensuring not only the maintainance but the increase of the wages, as being necessary to further improvements of the manufacture—elements which are, to a great extent, independent of the operation of the demand or supply of the ordinary labour.

"The present position of the cotton manufacture, relatively to the most primitive processes, may be thus illustrated:—

"At Calicut, in India, whence *calico* was first brought, or at the foot of the Himalaya mountains, where cotton is grown on the spot, it is spun with the primitive distaff, and it is there woven by a poor Hindoo weaver, who, in the open air, spreads his loom, of a construction as old as the Pharaohs, on which he works for a handful of rice a day, under the shade of a tree, for which he pays no rent. From those same spots, cotton has often been gathered for the supply of Lancashire; it is conveyed by an expensive land transport, on horseback, over primitive trackways, to a vessel, in which thirty or forty thousand pounds are invested, and in which it is carried half way round the world. From the port where it arrives it is conveyed on an iron road, the construction of which has cost upwards of thirty thousand pounds per mile, by a steam carriage, costing between one and two thousand pounds, to a manufactory, in which a hundred thousand pounds have been invested, in which a thousand persons are employed, who, with the aid of a steam engine, of 500-horse power—*i.e.* steam power equal to five thousand men, continually working—keep going one hundred and fifty thousand spindles, and deliver 879,110 yards, or 499 miles of threads per minute—or, in half an hour, an extent of thread which would reach beyond the place in India from whence the material was brought, or, in the working day of ten hours, an extent of thread that, from this one spinning mill, would wrap twelve times round the world. The poor Hindoo spinner can only spin a mile of thread for about fourpence, and he can spin it for no less, for it is, at the most, a bare and wretched subsistence. But, by the combination of capital and skilled labour, a lb. (of No. 40), 33,600 yards, or more than 1 miles of thread, is made for about three halfpence. The thread, thus manufactured, is often taken to be woven, in a shed on which eighty thousand pounds of capital have been invested, in which, under a tall furnace chimney, and the unpleasant shade of a cloud of smoke,—a thousand power-looms are worked by weavers, whose wages would often purchase ten or twelve pounds of rice a day, and that, too, brought from India. The average wages earned by the weavers in these power loom factories,—of which only one-fourth are male adults, the rest being young females,—are now upwards of eleven shillings a week.

"Chiefly in yarn, but now, to an increasing extent, in cloth, the manufactured product is carried back again half way round the world, and the poor rice-fed Hindoo weaver, as well as the spinner, is undersold; he is obliged to strike his loom, and often, be it observed, seek service, as a Sepoy, in fighting, for better pay and subsistance than could ever be obtained under his native princes;—to maintain the domination of the native by whom his ancient craft has been superseded; under which domination, it may be added, if administrative reform should prevail at its seat, and secure properly qualified and conscientious colonial administrators,—that wretchedly-paid labour will be found to have been superseded to the advantage of his race, to which, with security and justice, will be given abundance and material comfort unknown before in that part of the globe.

"Another branch of manufacture, that of machine-wrought lace, may be referred to as illustrative of the tendencies of the progress of manufacturing improvements which I have endeavoured to point out in respect to the manufacture of cotton yarn and cloth.

"An eminent Nottingham lace merchant, Mr. W. Felkin, has stated that with dexterity the knitter on the pillow might weave about five meshes a minute, and would occupy 600 hours of labour to make a square yard of plain lace. In 1810 the lace-making machines at Nottingham, then 36 inches wide, made 1,000 meshes in a minute, or a square yard in two hours. Now in 1856 the plain lace-making machine is 180 inches wide, makes 40,000 meshes in a minute, or a square yard in five minutes. In 1809-10, the finished pieces of plain net were sold at five pounds the square yard; in 1850, a period of depression, at fourpence, and now in 1856 at sixpence the square yard. As in the cotton trade, at first, when the supply was considered a luxury, and was made to hundreds, instead of to many thousands of consumers, the wages were very high, and may be treated as exceptional, for they subsequently fell severely low. In 1836, when the price of plain net had fallen to 10d. per yard, the wages paid for embroidering and finishing the lace were estimated at £350,000, divided amongst 35,000 hands. Now it is estimated that £2,200,000 in wages alone are divided amongst 130,000 hands engaged in that department of the Nottingham lace trade. In 1836, there were 3,800 bobbin-net machines, returning £2,212,000; in 1856, 35,000 larger machines, returning about £3,680,000. The returns of the entire lace-making trade are now stated at £4,040,000, of which the raw materials cost £980,000, leaving to be paid in wages, interest, wear and tear, and profits, £3,060,000. The entire number of hands is now stated at 135,000. The rate of wages on the machines for making plain lace has risen from 12s. to 16s. per week for boys, and from 20s. to 24s. per week for men. The wages for men to work the fancy lace machines have risen in larger proportion, or from 20s. to 30s., and from 25s. to 50s. per week, according to the class, skill, and attention to the work to be performed.

The plain lace now serves as the basis of varied patterns, wrought by hand, but it appears that every "useful" mesh, that is to say, in the manufacturing sense, every saleable hand-wrought mesh, is now imitated by machinery, where the numbers saleable of the same pattern make it worth while. Roman Catholic priests have adorned themselves with costly lace vestments, and have celebrated their rites before altars decorated with gorgeous lace cloths, imagining them to have been wrought in nunneries, or by the faithful of the Roman Catholic flock, but the labour of those poor Roman Catholic pillow workers, toiling at their five meshes a minute, for wretched wages—as shown in your statistical returns—wages which rendered unnecessary the prohibition of meat on the Friday, and which made their whole life one perpetual and forced fast, is now extensively superseded by Nottingham machine-made vestments, produced at the rate of a thousand meshes a minute, by fifty or even sixty shillings a week workers, to whom, or to whose families, fasts, forced or voluntary, are now unknown.

"The price of the Jacquard or fancy lace weaving machines, which are machines of the highest order of skill, is from £500 to £1,000 each or more. In respect to this new machine, a manufacturer made a statement to me to this effect, which will illustrate the general tendency of improved machinery:—"For working inferior and rude machines almost any man may be taken out of the streets and employed, at low wages without asking who he is, and on any slight stoppage he may be dismissed at once without care,—but not so with this improved machinery. It is a highly delicate and valuable property; it is a large amount of capital to put into one man's charge; a drunken or an ignorant man may in a minute do great damage; moral character and trustworthiness must now be sought for; inquiries as to these qualities must now be made before engagement; higher wages must now be paid for working the improved machine to workmen of higher character as well as of skill. When engaged they cannot be summarily dismissed with safety, for a substitute may not be found without great trouble; moreover, the wear and tear and interest on the machine is at least £1 per diem, and there is, therefore, a penalty to that amount on the owner of the machine for every day he omits to find work and keep the artizan employed at these high wages. Under these circumstances the owner becomes, to a greater extent than may be supposed, the servant of the operative.

"The place of rude hand labour is, in the first instance, often only supplied by rude machine labour, but as machinery is improved, the economical condition of the labourers is everywhere, and must, I apprehend, continue to be, improved with the character of the machinery.

"In the immediate vicinity of the lace machine trade there was the stocking manufactory with machines of an inferior character. Ten years ago, the wages were the most deplorably low of any I have met with in the mafacturing districts of England, as they were not more than from 5s. to 10s. per week clear wages. I am glad to learn that now, as a consequence of the introduction of the rotary circular stocking machine, the wages of the work-people have been raised from 10s. to 20s. per week, and that for fewer hours of labour, and that labour of a lighter character.

"As a general rule, we must anticipate that all labour which consists of repetitions of motion by hand will be executed by machinery. Sewing machines appear to be making way, and are substituting, at the least, double wages for the wretched wages formerly obtained by sempstresses. I have seen shoes of a superior appearance made in less than one hour each pair, by a new machine, which will, I am assured, substitute better-paid labour for the common manual labour. It is to be hoped, for the sake of humanity, that machinery will be brought to bear in quarrying and mining operations, especially in those for the extraction of coal.

"The like elements in the progress of improvements in machinery and in processes, requiring more and more of machinery or capital to be put under one management, and more of skill and responsibility on the part of the workers, noticed in respect to the lace-making machine, are in a degree displayed in the progress of the cotton manufacture, and chiefly account for the steady increase of wages already stated. And these elements have hitherto been actually most strongly developed in the cotton manufacture in England during periods of manufacturing depression.

"The periods of manufacturing distress have, heretofore, been the chief periods of improvement to the labouring classes themselves. It was an aphorism of the father of the cotton manufacture in England, Mr. John Kennedy, of Ardwick-hall, recently deceased, whose first spinning was by hand—then by a machine worked by a donkey—then by a horse—then by a Newcomen's engine—and, lastly, by a Watt of 500 horse-power, and who had taken part in all the vicissitudes of the cotton manufacture from its commencement, that latterly no extensive improvement was made in the manufacture, except in periods of *threadbare profits*. At those periods, when demand is slackened, when prices fall, the manufacturer is driven to consider and execute whatever improvements he or others can devise, by which the expense of production may be reduced, and his profits be maintained at the reduced price of the market. If he have steam-power looms, he finds out that two looms, now superintended by two men, at 11s. per week wages, may be superintended by one man. But that one man must be the most clever workman, and, having so much additional machinery under his charge, he must, moreover, be a trustworthy one. Such a workman cannot at once be got from the common labour market; or, even if he were got under the pressure of the most intense and general distress for the time, he certainly would not be got to keep up an interest so as to enable him to continue such important work at the present miserable rate of wages of the less skilled labourer. In actual practice, however, wages are raised in the mode stated, and he gets one half more wages in the midst of a market depressed by redundant hands. In the spinning machinery, it is found that one man may be made to superintend the working of more spindles, or else the speed of the machinery is increased. In weaving, more cloth is turned off in the hours, now reduced to 60 a week, than was formerly turned off in 76.

"I found, on investigation, the term self-working machinery delusive; that, although a self-acting mule, as it is called, might be worked by a young person, at 9s. or 10s. a week wages, yet the manufacturer finds it worth while to give 18s. a week for the qualities of labour and superintendence most safe and productive. I found, also, that with apparently self-acting machinery, there were very large differences between one day when the workmen worked "with a will," and another when they were indifferent, which fact formed one ground, amongst others, for my supporting a reduction of the working hours of labour, in the confidence that by greater attention and energy within the reduced time, the quantity of work would be made up; and this confidence has been justified by the event, but it has required increased skill and attention. From the most impartial testimony which I have been able to obtain, I am led to believe that Lancashire has less to fear than ever from the low-priced and unrestricted labour and long hours of the cotton manufacturer of other countries.

"An eminent cotton-manufacturer in Austria, who uses the most improved English machinery, assures me that, with the labour there of thirteen hours and more per diem, he does not get more produce turned off than is turned of in ten hours and a half in Manchester. The late Mr. Bourcart, an eminent cotton manufacturer at Alsace, assured me that, if he were merely to regard his manufacture as an investment, and he were to begin the world as a manufacturer, he would, for the sake of the more active and skilled labour, set up his mill in Lancashire. The chairman of a committee of woollen manufacturers at Leeds, sent on the occasion of the Great Exhibition of 1851, to examine the works of the competitors whom they would have to meet, stated to me, that the best were to be found in Belgium, but that, although he paid one-third more wages in Yorkshire, he got his yard of cloth of the like quality as cheaply made there as the Belgium masters did with their labour.

"The like tendency to those above described, of putting more and more of machinery, that is, more and more of capital under the care of one person, requiring higher qualifications, and insuring higher pay, has been displayed in other branches of manufacture than those of textile fabrics; thus in machine working, at a period of distress, it was found out, that instead of two planing machines being superintended by two men, at 16s. or 18s. per week wages each, those machines might both be superintended by one man, at 24s. per week.

"The painful impressions created by the spectacle of manufacturing distresses and the troubles attendant upon them, which have perplexed statesmen of the older school, and made them wish we were without these new manufactories, and hope that the experience of the last reverses will at least have served to give them a decided check—have not been effaced, when returns are received, showing large investments of capital in new establishments, and the great numbers of additional population which will be required to work them, which facts are received as proving an astounding recklessness of speculation. On inquiry, however, I have always found that the capitalists knew best what they were about, and that the investment, instead of being more dangerous, was in reality more safe than ever.

"The economical sequence has appeared to me to be as follows:—

"Long depressed markets have necessitated the consideration and adoption by the manufacturer of improvements in processes and machinery by which the cost of production is lowered to meet the fallen demand.

"These improvements have necessitated for their execution improved labour at improved wages.

"The reduced price rendered possible by the reduced cost of production, has brought the commodities within the reach of greater numbers, and has stimulated and extended the habitual consumption.

"The restored and extended demand, has in the case of articles of what may be deemed primary necessity for civilised life, been from a higher to a lower class of consumers, who are the least affected by the fluctuations of fashion, or disposed to sudden changes of habit; and hence the consumption is placed upon a wider and firmer basis, rendering employment at the improved wages less liable to extreme fluctuations.

"The improvements in processes and machinery which have occasioned a demand for improved labour, are attended with the additional security to the operative, that they compel the manufacturer to resort rather to short time and struggle to the last before he stops his works, for if he once disperses his whole establishment he may not again get such another together, and on such occasions, he often finds himself in this position, that whilst he manufactures without a profit or even at a loss, he will incur more loss by the deterioration which his machinery undergoes when stopped than by keeping the works going.

"One circumstance which, on the occasion of the depression of cotton manufacturers, constitutes an element of future extension, is this, that the old established home market is the last in which the manfacturer will reduce his previously settled prices; to avoid disturbing them so long as he can help it, he prefers making sacrifices, selling his goods in any out of the way or strange market, unknown to the common home trade;—then young men tempted by the low price of goods, take cargoes of them as ventures to China, or elsewhere, and lay the foundations of new demands. Then too, with the aid of a man, which my friend, Mr. Senior, in his lecture on political economy at Oxford calls 'the great corrector of mischievous legislation, the smuggler;' customs barriers are broken down with the low-priced goods, and incursions are made in the districts where prices are kept high and consumption is checked, by protective legislation.

"Whilst wages from the causes stated have been improved, and must, I believe, from those causes be maintained, the manufacturer's profits, from the competition of new capital, induced by the greater safety of investments consequent on the extended demand, have been reduced.

"At present the general average profits on capital applied to manufactures are understood to be below 10 per cent., or about 7½ per cent., which is understood to be about the rate of profit obtainable by investments in improved and skilfully conducted agriculture. As an example of the progress in respect to the profits of manufacturers, it may be mentioned that the first Sir Robert Peel, whom recently living people remembered to have seen as a poor boy carrying milk, made his large fortune by printing pieces of cotton at a guinea each piece, and at the time I was last in Lancashire that same description of pieces was under manufacture in large quantities for exportation to India—material, weaving, cloth, printing, and all—at half the price which he obtained for printing alone.

"The proportions of bankruptcies to the capital employed, and of the stoppages of works, have really diminished with the extension of the manufactures in question. Formerly, in the earlier stages of manufactures, and in the narrower fields of consumption, the fluctuations chiefly arose from the caprices of fashion; now they are dependent chiefly on the larger causes affecting populations, bad harvests, epidemic seasons, national disturbances, threats of war, mal-administration, and unproductive war taxation.

"On the announcement of projects to introduce new machinery, immediate apprehensions are entertained of its effects on those whose labour is superseded. Economists, who are advocates for the use of machinery, urge in mitigation of its assumed effects, that its introduction is necessarily gradual. Entertaining such apprehensions myself, I was early prepared to consider, in poor law administration, measures of a special character for the relief of the labourers whose services had been discontinued by the introduction of labour-saving machinery.

"In investigating the administration of relief in England, I looked with particular interest on some fields of extensive improvement in machinery and processes, for the destitute labourers and their families, who, as it might fairly be anticipated, must have been reduced to pauperism by such improvements, but, as a class, there was nowhere a trace of them, and the existence of particular cases from that cause on the pauper rolls was extremely doubtful. In one instance, where, by the introduction of Mr. Whitworth's street-sweeping machine into one large town district, the labour of the entire body of the sweepers by hand had been displaced. I confidently expected that that class, at least, who were of the lowest labourers, and the least capable of changing the object of their labour, would be found, as a class, on the destitute relief list; but, as a class, they were not there, and having obtained a list of them, I directed inquiries to be made into the individual cases, as to what had become of each of them. About 8 per cent. of them had died. Considering the class, many of whom were old and feeble, this, for the time, was not a mortality beyond the average. Of about six per cent. of them no account could be got, but the rest had found other, and on the whole actually better paid work. Under the stimulus of an extraordinary necessity. they had found out for themselves miscellaneous services, for which, under that stimulus, they qualified themselves,—which services no one else could have anticipated or found out for them;—some had become stokers or firemen for steam-engines, some had become machine-drivers, some had entered the police, and none had fallen below their former position, which indeed was scarcely possible. To the whole of those who had gained employment, the privations and even the severities of the displacement appeared clearly to have been compensated. I have directed inquiries into other and larger displacements of labour, with similar results. To have provided any special and indulgent relief in order to graduate the changes, would have lowered the stimulus under which the new benefits to themselves were achieved, and would have simply done mischief. With the like care that a surgeon has for the safety of a patient, in resisting interference with the operations of nature, I have resisted interference by special doles or allowances of public relief; with this economical, absorbing process, and with the stimuli to exertions natural to such occasions. I could display the effects of well meant but ill-informed interference in such cases in occasioning much severe and protracted suffering. The cases of the retention of partial employment by relief in aid of wages in a contest with steam power, as by hand-loom weavers against steam-power loom weavers for common goods, were of severe and protracted misery.

"Thus, amongst the economical results displayed of the improvements in processes and machinery are these, that, where labour is saved, or rendered more productive thereby, capital is increased: and the increased investment of capital increases the demand for labour, and thence increases what I call the absorbent power of the labour market, to re-absorb the displaced labour. And to meet these changes sound education is advantageous, as increasing the aptitudes of labourers to learn new employments.

"In the consideration of the future of our manufactories, I may state that I have at times directed particular inquiries to be made in respect to the consumption of manufactured goods in Great Britian.

"At a time when there was much suffering amongst the stocking weavers of Leicester and Nottingham, in consequence of a reduction of demand, there were loud outcries and allegations of over-production. It appeared, however, that if all the stockings then manufactured were consumed in the United Kingdom (and a very large proportion of those manufactured were exported), the supply would scarcely amount to one pair of stockings per annum per head of the population. The great bulk of the labouring population of Ireland, Scotland, and Wales, were without stockings; the adult labouring population of England and their children were very imperfectly supplied with them. It is a fact to be noted by the way that those who wear shoes without stockings, do not save by the privation, for the shoes wear out the faster. In our own colonial possessions, there are large proportions of the population who only wear a sort of moccasin, or prepared skins, as shoes or stockings. I have also directed particular inquiries to be made as to the consumption of cotton, linen, and other materials of clothing by our population. I found large classes of workpeople in receipt of such wages as from 18s. to 24s. per week, who had only two shirts each, one on and one off; many of them had only one shirt, which they wore until it fell to pieces. Taking the clothing in use for the poor maintained in public establishments as the standard of necessity, our own labouring population is even now, speaking generally, very poorly clad, and there might be, even at the present prices, an extended home consumption, but there is still great room for improvement in the qualities of manufactured articles and their fitness for use, for warmth, lightness, cleanliness, durability, and ornamentation, as well as cheapness, to bring them still more within the means of all. If, in England even, there is room for a considerable extension of the consumption of manufactured articles, and consequently for the extension and improvement of the manufactures, and, consequently, for the improvement of the condition of the artizans, much more so is there in other countries. At the time of the English exhibition of the Industry of all Nations, I was in communication with members of local committees of manufacturers, who, for the first time, went upon the continent to examine the manufactures with which they would have to compete. One general conviction expressed to me by several of them on their return was, that there was abundant room in each country for extended consumption within itself, and for the further development of its own manufacturing industry if it thought fit, without any injury to any other. And looking at the primary necessities of populations, I believe that the field for an extended consumption of manufactured goods is much larger than is yet conceived, even by manufacturers.

The elements of the progress here indicated are, it is to be observed, mainly economical elements. The physical, educational, and social elements are, for the most part, essentially distinct, and these, when pourtrayed in their present condition, present sadly reversed pictures, dreadfully wide-spread evils, but, when they are closely examined, these will be found to be, in a great measure, preventable by improved legislation and improved administration."

He then proceeded to give illustrative instances to show that the introduction of improved machinery and processes into agriculture, was attended with similar economical results, tending to the improvement of the wages of the labourer.

Proceedings of Institutions.

FALKIRK.—On the 29th ult. the session of the Falkirk School of Arts was opened by an address from the Lord Advocate. Upwards of a thousand persons were present. The right hon. gentleman was accompanied to the platform by Robert Adams, Esq., Provost of Falkirk; Sheriff-Substitute Robertson; the Rev. Lewis H. Irving, minister of the Free Church; Mr. Macfarlane, of Thornhill; Mr. Wilson, of Bantaskine; Mr. James Russell, jun., of Arnotdale; Dr. Hamilton; Mr. Wilson, writer; Bailie Patrick Gentleman; Mr. John Gentleman; Mr. Charles Scoullar, of the Falkirk brewery; Captain Spoirs, of Culcreuch; and other gentlemen interested in the School of Arts and in the locality. The chair was taken at a quarter past eight o'clock, by Provost Adam, who introduced the Lord Advocate in a complimentary speech. The Lord Advocate said, that he should have felt it an honour to be asked to address a school of arts in any circumstances; but looking at this Institution as one of the very foremost in the race of knowledge and progress which has been going on at such speed for the past twenty years, and considering that it dates so far back as twenty-nine years ago, he felt the greatest possible pleasure in obeying their summons on this occasion. His lordship, after enlarging upon the advances made in civilisation during this period, and the increased appreciation shown to such Institutions as this, said he had been led into reflections on the spirit of nationality by the numerous historical associations connected with the town of Falkirk. He then proceeded to make some remarks on the national character, position, and history of Scotland. After reviewing the character of Geo. Buchanan and other great men belonging to their past history, his lordship proceeded to show, from the literature of both countries produced during the reign of Elizabeth, that there was then no difference in the dialects of England and Scotland. He then touched upon that feature in Scottish history which rose superior to all other national events, namely, the Reformation. His lordship pronounced a warm eulogium upon the devotion which the commonality of Scotland had ever displayed—in the time of Wallace, when deserted by the nobles, and subsequently, both at the Reformation and during the ecclesiastical troubles. Coming to the Union, he gave a graphic picture of the new phases which it developed in the career of the Scottish courtier. After eulogising the memory of Henry Dundas and the Scottish Jacobites, his lordship glanced at three names as typical of Scotch character during the last century. The first, Duncan Forbes, of Culloden; the second, David Hume, who was emphatically the man of the last century, and the third, Robert Burns, who had preserved in a classic form, that language which bade fair to pass into a barbarous jargon. He likewise briefly alluded to the great cause of education, particularly the amelioration of the great masses of people which our commerce and manufactures had brought together.

MEETINGS FOR THE ENSUING WEEK.

MON. Architects, 8. Part II. "Description of the works executed and now in progress at Alnwick Castle, Northumberland."
Chemical, 8. Mr. E. O. Brown, "On a New Volumetric Method for the Determination of Copper."
TUES. Civil Engineers, 8. Adjourned discussion upon Mr. D. K. Clark's paper "On the improvement of Railway Locomotive Stock."
Linnæan, 8.
Pathological, 8.
Statistical, 8. Rev. John Clay, "On the relation between Crime, Popular Instruction, Attendance on Religious Worship, and Beer-houses."
WED. Society of Arts, 8. Colonel Sykes, F.R.S., Chairman of Council, "Address on the opening of the One Hundred and Third Session."
Geological, 8.—8. Dr. Buist "On the Occurrence of Crystallization in Stucco, and on other instances of changes in Molecular Arrangement." 9. Professor James Nicol "On the Red Sandstone and Quartzite of the North-west of Scotland."
THURS. Antiquaries, 8.
Philological, 8.
Royal, 8½
SAT. Royal Botanic, 3½.
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 7th*, 1856.]

Dated 15th July, 1856.

1634. Arthur Neild, Manchester—Improvements in Jacquard and other pattern looms. (A communication.)

Dated 1st August, 1856.

1822. John Avery, 32, Essex-street, Strand—Improvements in bonnets and other coverings for the head. (A communication.)

Dated 6th August, 1856.

1858. James Braby, Borough Haymarket, Newington Causeway—Improvements in sawing machinery.

Dated 24th September, 1856.

2234. Antoine Jean Baptiste Lespinasse, Toulouse—Improvements in the means of obtaining motive power.

Dated 25th September, 1856.

2246. Henry Joseph Marie Edouard Silvy and Amedée Anne Henry Plagniol, Paris—Improvements in harness.

Dated 15th October, 1856.

2408. Edward Hallen, Cornwall-road, Lambeth—Improvements in the construction of chairs, sofas, bedsteads, and similar articles of furniture to sit or recline upon.

Dated 21st October, 1856.

2464. Charles Briqueler fils, 22, Rue Emery, Dunkerque—The purification, clarification, and discolouration of the cotton seed oil.
2466. John Cowdery Martin, Fern-cottage, Charlewood-road, Putney—An improvement in glazing paper.
2468. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—An improved knitting loom. (A communication.)
2470. William Smith, 10, Salisbury-street, Adelphi—Improvements in water level and pressure indicators and lubricators. (A communication.)
2472. Robert Davison Atkinson, Kingston-upon-Hull—Improvements in preparing and coating metallic surfaces. (A communication.)
2474. George Thomson, Westbourne-green, Harrow-road—Improvements in machinery for cutting or rending wood for laths and other uses.
2478. George Webster and James Webster, Fountain-yard, Bridge End South, Leeds—Improvements in the means of opening and closing the slide valves of engines worked by steam or other power.

Dated 22nd October, 1856.

2480. Godfrey Ermen, Manchester—Certain improvements in machinery or apparatus for the finishing and treatment of yarns or threads.
2481. Frederick Walton, Haughton Dale Mills, near Denton, Lancashire—Certain improvements in the manufacture of brushes.

2482. George Chappell Potts, New Oxford-street—The application of certain materials to the cleaning of casks.

Dated 23rd October, 1856.

2483. Charles Weightman Harrison, Woolwich—Improvements in the insulation and protection of electric conductors.

2484. Thomas Gray, Ratcliff-works, Rose-lane, Stepney—An improved drying apparatus.

2485. John Francis Porter, 11, Park-street, Westminster—Improvements in the manufacture of bricks and other articles of clay and brick earth, or of the like materials.

2487. John Christian Bremer, 166, Fenchurch-street—Improvements in propellers.

2488. John Macdonald, 13, Henry-street, Upper Kennington-lane, Vauxhall—Improvements in regulating the supply of oil or other liquids, applicable to lamps, gas meters, and other useful purposes.

2489. Nehemiah Brough, Birmingham—Improvements in dress fastenings.

2490. Albert Demerit Bishop, Woolwich—Improved apparatus for facilitating the finding and raising of vessels and submerged articles.

2491. Theophilus Horrex, South-square, Gray's-inn—Improvements in fastening buttons and other similar articles on to garments and other things.

2492. John Walley, Derby—Improvements in the means of preventing explosions in steam-boilers.

2493. John Dearman Dunnicliff and Walter Dexter, of Hyson-green, Nottingham—Improvements in warp machinery.

2494. Leonard Alexander Desachy, Great Marlborough-street—Improvements in producing architectural mouldings, ornaments, and other works of art formed with surfaces of plaster or cement.

2495. Edward Allan Athawes, 63, Blackfriars-road—An improvement in the construction of forks for forking land.

Dated 24th October, 1856.

2496. James Eglington Anderson Gwynne, Essex-wharf, Essex-street, Strand—Improvements in the manufacture of carbon or charcoal powder for various useful purposes.

2497. Isaac Bailey, Bradford—Improvements in machinery for spinning wool, cotton, alpaca, mohair, and other fibrous articles.

2498. George White, Bromley, Middlesex—An improvement in the treatment of grain, in order to produce starch and spirit therefrom.

2499. Richard Archibald Brooman, 166, Fleet-street—An improved oil for burning in lamps and an improved burner and chimney. (A communication.)

2500. William Woodford, Taunton—The prevention or cure of smoky chimneys.

2501. Robert Struthers, Holyhead—Improvements in machinery or apparatus for tranmsiting motive power.

2502. William Mills, Congreve-street, Birmingham—Certain improvements in apparatus for cleansing or removing the soot from chimneys.

2503. Howard Ashton Holden, Bingley-hall Works, Birmingham—Improvements in furniture for railway and other carriages, and which said improvements are also applicable as a means of finishing or ornamenting the iron parts of harness and other articles made of iron to which such mode of finish or ornamenting has not heretofore been applied.

2504. Louis Auguste Mangin, 39, Rue de l'Echiquier, Paris—A self-acting door-spring.

2505. Samuel Baxter, Minories—Improvements in chain wheels, or barrels and stoppers to be used for raising and lowering weights by means of chains.

2506. Charles Anciaume, 15, Quay Bourbon—Improvements in musical organs, both sedentary and portable.

Dated October 25th, 1856.

2507. Gustavus Ernst and William Lorberg, Manchester—An improved mode or method of raising or producing designs, patterns, or impressions on the surfaces of plates, blocks, or rollers, and transferring or imparting the same to paper, parchment, woven fabrics, leather, or other similar materials.

2509. Charles James Farrington and William Comber, Hampstead—Improvements in means or apparatus for giving alarm in case of attempted burglaries.

2511. George Henry Bachoffner, Upper Montague street—Improvements in glass shades for gas and other artificial lights.

2513. Henry Forfar Osman, 33, Essex-street, Strand—An improved contrivance for distending the skirts of ladies' dresses, and preserving the required form and shape thereof. (A communication.)

Dated 29th October, 1856.

2534. Richard Robinson, Eccles New-road, Pendlebury, Lancashire—An improvement or improvements in machinery or apparatus for sizeing, dressing, finishing, and polishing yarns or threads.

2536. Thomas Garnett, Low Moor, Clitherhoe, Lancashire—Improvements in the manufacture of paste or size for sizing, stiffening, or otherwise preparing cotton and linen yarns and woven fabrics.

2538. Louis Adolphe Faure, Paris—An improved pump.

2540. Thomas John, Pesth, Hungary—A new electric telegraph apparatus for writing.

2542. Arthur James Thompson, Birmingham—An improved gum-pot and brush, and which said pot and brush are also applicable for holding and using liquid glue, paste, or other adhesive materials, as well as varnish, paint, and such like fluids, which are liable to dry up by the action of the air.

2544. Charles De Jongh, Lautenbach, near Guebwiller, France—An improved method of and machinery for combing and preparing silk, flax, and other fibrous substances.

2546. Frederic Whitaker, 4, Canonbury-road—Improvements in apparatus for supplying water to steam boilers.

2548. David H. Whittemore, Worcester, Massachusetts, U.S.—An improved machine for paring, slicing, and coring fruit or vegetables.

Dated October 30th, 1856.

2550. William May, London—Improvements in steam engine indicators. (A communication.)

2552. Henry Holcroft, 39, Rue de l'Echiquier, Paris—An improved steam-engine, specially applicable to agricultural operations.

2554. James Simpson and Henry Spencer, Rochdale, Lancashire—Improvements in lubricating steam engines.

WEEKLY LIST OF PATENTS SEALED.

Sealed November 7th, 1856.

1100. Louis Beauche.
1101. George Simpson.
1105. Richard Archibald Brooman
1142. Charles Gibson.
1146. John Cox.
1156. William Marychurch and John Griffiths.
1218. Alexandre Hubert.
1228. James Howard and George Williams Baker.
1246. Robert Adam Whitlaw and Alexander Mitchell, jun.
1256. Bennet Johns Heywood.
1282. John Weems and John Henderson McCrindell.
1416. Joseph Sutcliffe and James Leech.
2046. Edmund Pim Spiller.
2056. Eugene Armand Roy, John Archibald Hall, and William Thomas Binns.

Sealed November 11th, 1856.

1141. Charles Henry Olivier.
1153. Charles Richard Williams.
1157. Matthew Townsend.
1176. Richard McCloy and John Hare.
1178. George Carter.
1212. Thomas Lawrence.
1229. Thomas Dawson Russum.
1251. Andre Adolphe Gaget.
1296. Robert Blackwood, sen.
1310. Edward Marsden.
1318. John Henry Johnson.
1406. Peter Armand le Comte de Fontaine-moreau.
1600. George Bradshaw Watkins.
1644. Alfred Nicholson Wornum.
1988. Edward Alfred Cowper.
2027. Thomas Pinfold Hawkins.
2162. Alfred Vincent Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

November 3rd.

2547. Peter McGregor.
2567. William Foster.
2570. John Banks Nicklin.
2613. Richard Dryburgh.
2648. Joseph Fry.
2694. John Gerald Potter and Robert Mills.
2742. Davidson Nicholl.

November 5th.

2594. John Henry Johnson.
2785. John Hewitt.

November 6th.

2614. William Steel.

November 7th.

2581. Marino Louis Joseph Christophe Vincent Falconi.
2710. William Mee.

November 8th.

2671. Robert Griffiths.
2757. Joseph Stenson.
2841. Lewis Harvey Bates.

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ERRATA.

Page 27, col. 1, line 66, for *Hemming*, read *Herring*.
" 75, col. 1, line 44, for *Prussia*, read *Persia*.
" 123, col. 1, line 2 from bottom, for *not one house of any repute*, read, *not any of the great houses*.
" 167, in the account of Major Pratt's patent, No. 3,309—1810, for, *a series of ploughs revolve on a horizontal axis*, read, *a series of ploughs revolve horizontally on a vertical axis*.
" 209, col. 1, 17 lines from bottom, for £120,000, read, £1,200,000.
" 262, line 11, for, *for feeding cattle*, read, *as a dressing for wheat*.
" 362, col 2, line 39, for *steel pins*, read *steel pens*.
" 363, col 1, line 12 from bottom, for, *unwise enough to* lose *the importation*, read, *unwise enough to* tax *the importation*.
" 404, col. 2, line 31, after *engraved rollers*, take out the semicolon, and insert a semicolon after *purpose*, in line 32; and in line 40, take out *but*.
" 413, in list of members elected, for *Niblet* read *Niblett*.
" 420, col. 2, line 12, for *it was stated*, read, *he stated*; and lines 17 and 18, for, *Professor Hoskyns, the official referee of the insurance companies*, read, *Professor Hosking, the official referee*.
" 440, col. 1, line 2, for *only* read *chiefly*.
" 460, col. 2, line 16 from bottom, for *Bentley, Richard*, read *Bentley, Professor Robert*.
" 568, col. 2, under head Examinations, first line, for *I*, read *We*.
" 575, col. 1, line 10, for *Telkin*, read *Felkin*.
" 610, col 2, line 11 from top, for *Kopäes*, read *Kopaïs*; in same column, in note, line 2, for *der*, read *den*; same column, same note, for 1855, read 1835.
" 611, col. 1, line 7, insert *near* between *on* and *or*.
" 612, col. 1, line 23, for *Amterhausen*, read *Amtenhausen*; same page, col 2, line 35 from the bottom, insert *to* between *waters* and *sink*; in line 9 from the bottom, for 1820, read 1840; and last line but six, after *beds* dele (").
" 633, col. 2, note, line 1, for *Brunnenstaben* read *Brunnenstuben*; line 4, for *Meber Arlegung*, read *Ueber Anlegung*; line 6, for *Breisganes* read *Breisgaues*: line 7, for *Fromberg* read *Fromherz*.
" 634, col. 1, line 17, for *Brunnenstaben*, read *Brunnenstuben*; notes, line 3, for *Auerstedt*, read *Quenstedt*; line 21, for *Zahrbücher*, read *Jahrbücher*.
" 636, col. 1, notes, line 7, for *Auellen*, read *Quellen*; line 9, for *Perisdicität*, read *Periodicität*; and for *Auellen*, read *Quellen*; col. 2, line 2, for *Buschelesteich*, read *Büschelesteich*.
" 637, col. 1, note, line 2, before *Fertigung*, insert *zur*.
" 638, col. 1, note, line 19, for *obserwäbischen*, read *oberschwäbischen*.
" 745, col 1, No. 165, for *The Principles of Great Circle Sailing with Physical Geography*. read, *The practice of Great Circle Sailing with the principles of Physical Geography*; and insert, No. 165A, For a simple Telescope of moderate price, to determine distances to 1000 yards.